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Hawai`i's Local Action Strategy to Address Land-Based Pollution Threats to Coral Reefs

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U.S. Department of Agriculture-Natural Resources Conservation Service
Hawai`i State Department of Health
Hawai`i State Department of Land and Natural Resources
Hawai`i State Department of Business, Economic Development and Tourism-Coastal Zone Management Program
National Oceanographic and Atmospheric Administration
U.S. Fish and Wildlife Service
U.S. Geological Survey
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Abbreviations and Acronyms

BMP	Best management practice
CRAMP	Hawai`i Coral Reef Assessment and Monitoring Program
CZM	State of Hawai`i Coastal Zone Management Program
DAR	State of Hawai`i Department of Aquatic Resources
DLNR	State of Hawai`i Department of Land and Natural Resources
DOH	State of Hawai`i Department of Health
EMoWP	East Moloka`i Watershed Partnership
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
gpd	Gallons per day
HCRI	Hawai`i Coral Reef Initiative
HWH	Hanalei Watershed Hui
MLCD	Marine Life Conservation District
MLP	Maui Land and Pineapple Company
MLSWCD	Moloka`i-Lana`i Soil and Water Conservation District
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRCS	Natural Resources Conservation Service
TNC	The Nature Conservancy
USACE	U.S. Army Corps of Engineers
USCRTF	U.S. Coral Reef Task Force
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WMSWCD	West Maui Soil and Water Conservation District
WRAS	Watershed Restoration Action Strategy

Section 1.0
Overview and Major Recommendations

1.0 Overview and Major Recommendations

Coral reefs around the world are threatened by a diverse array of human activities resulting in overexploitation and degradation of these valuable ecosystems. The U.S. Coral Reef Task Force (USCRTF) identified six priority areas for future work by federal agencies and states to address critical threats to and protect coral reefs in the United States (National Oceanic and Atmospheric Administration [NOAA] 2002a). These six priority areas include land-based pollution, overfishing, lack of public awareness, recreational overuse, climate change, and coral disease.

Land-based sources of pollutants, such as sediment, nutrients, and other pollutants, are one of several factors threatening the quality of coral reef ecosystems in Hawai`i. These pollutants are transported in surface water runoff and by groundwater seepage into coastal waters. While the complex interrelationship between land-based sources of pollution, water quality, overfishing, and the health and integrity of coral reef ecosystems is not well understood, enough is known to require management policies that minimize polluted surface water runoff and prevent overfishing (Davidson et al, 2003).

This document presents the State of Hawai`i's local action strategy to address land-based pollution threats to coral reefs. The U.S. Environmental Protection Agency (EPA) and the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) volunteered to facilitate the development of the local action strategy to address land-based pollution impacts on coral reefs. An overview of the strategy and major recommendations are presented, followed by watershed-based action plans for three priority areas. Cross-cutting action strategies are proposed as statewide and regional initiatives, including coordination activities needed to enable full implementation of this strategy to achieve the defined goals and objectives. The funding status of proposed actions and possible funding sources are provided as appendices.

Hawai`i's local action strategy provides an overall framework to document the significant ongoing efforts in the state to address land-based pollution threats to coral reefs as well as to guide the development of new priority actions. Specifically, this strategy was developed to:

- Provide a mechanism to document, consolidate, and share ongoing efforts to address land-based pollution threats to coral reefs in Hawai`i
- Identify new actions needed to address land-based pollution threats for priority funding
- Improve coordination and collaboration between federal and state agencies responsible for pollution prevention and coral reef management in Hawai`i

Hawai`i's local action strategy is watershed-based and incorporates the traditional land and natural resource management system, known as ahupua`a. Ahupua`a are watershed areas that encompass water source areas in the mountains and extend offshore to include coral reefs and coastal resources. Traditionally, each ahupua`a contained nearly all the resources Hawaiians required for survival (Kamehameha Schools Press 1994).

A collaborative planning process was used to develop this local action strategy. The strategy includes overall goals, objectives, and measures of success for Hawai`i's local action strategy; descriptions of priority ahupua`a in the main Hawaiian Islands for focused action; and descriptions of existing and new actions needed to address land-based pollution threats to coral reefs in these priority ahupua`a. New actions deemed essential to achieving the goals and objectives of this local action strategy are proposed for priority funding.

Local action strategies to address other threats to Hawai`i's coral reefs (fisheries, lack of public awareness, recreational overuse/misuse, and alien species) are also being developed through collaborative working relationships with federal and state agencies. The extensive coral reef ecosystems in the uninhabited Northwestern Hawaiian Islands were not addressed in this plan.

1.1 Collaborative Planning Process

A steering committee was formed to facilitate the development of the local action strategy and improve coordination and collaboration between key federal and state agencies. The steering committee is composed of representatives of the following federal and state agencies:

U.S. Environmental Protection Agency (EPA)
USDA, Natural Resources Conservation Service (NRCS)
National Atmospheric and Oceanic Administration (NOAA)
U.S. Fish and Wildlife Service (USFWS)
Hawai`i State Department of Land and Natural Resources (DLNR)
Hawai`i State Department of Health (DOH)
Hawai`i State Coastal Zone Management Program (CZM)
U.S. Geological Survey

Statewide and Pacific regional workshops were conducted with stakeholder groups to define goals and objectives and to identify priority ahupua`a and projects to include in the local action strategy. The workshops provided a venue to discuss issues, gaps, and needs for addressing land-based pollution threats. With input from these workshops, the steering committee developed the overall goals and objectives for Hawai`i's local action strategy and identified three priority ahupua`a for focused action: Honolua, Maui; Kawela to Kapualei, Moloka`i; and Hanalei, Kaua`i (Figure 1.1 and see Section 1.2). Focus group discussions were then held with stakeholder groups from each area to document ongoing actions and to identify new actions for priority funding.

Workshops Conducted to Develop Hawai`i's Local Action Strategy to Address Land-Based Pollution Threats to Coral Reefs
Hawai`i Scoping Workshop, March 12, 2003, O`ahu ***Participants:*** Representatives from federal and State agencies, academic institutions, and nongovernmental organizations involved in land and coastal resource management ***Process:*** Presentation and focus group discussions ***Outcome:*** (a) Established a communication network of land managers and coral reef scientists. (b) Developed list of ahupua`a consisting of areas where the link between land management and coral reef health could be demonstrated. (c) Drafted preliminary list of projects and partnership throughout the state. (d) Drafted preliminary goals and objectives of the local action strategy.
Hawai`i Stakeholders Workshop, June 9, 2003, Maui** ***Participants:*** Representatives from stakeholder groups in West Maui and Moloka`i including landowners, nongovernmental organizations, State and federal agencies ***Process:* Presentations and focus group discussions ***Outcome:*** (a) Identified key partners in selected ahupua`a. (b) Identified ongoing and potential new projects to reduce land-based pollution in each watershed.
Pacific Regional Workshop, June 24, 2003, O`ahu** ***Participants:*** Representatives from federal and state agencies, academic institutions, and nongovernmental organizations from American Samoa, Guam, Commonwealth of the Northern Marianas Islands, and Hawai`i ***Process:* Presentation and open forum ***Outcome:*** (a) Established communication network among U.S. Pacific Islands addressing land-based pollution threats to coral reefs. (b) Shared approaches, successes, and tools. (c) Identified common concerns and resource needs.
Inter-Agency Review and Fund Sourcing Meeting, January 7, 2004, O`ahu** ***Participants:*** Representatives from federal and state agencies, private sector, nongovernmental organizations and stakeholders from priority ahupua`a in Hawai`i ***Process:* Presentation and discussion ***Outcome:*** (a) Presented Local Action Strategy and priority projects and funding needs to federal and state agencies, private sector, and nongovernmental organizations. (b) Identified preliminary funding sources and amounts for priority projects (Output is summarized in Appendix A).
Maui Stakeholder Meeting, February 13, 2004 ***Participants:*** Representatives from federal, state, and Maui county agencies, private sector, nongovernmental organizations, and other stakeholders from the priority Honolua ahupua`a, Maui ***Process:*** Presentation and open forum ***Outcome:*** (a) Presented Local Action Strategy and priority projects for Honolua, Maui to stakeholders. (b) Received additional public comments and suggestions for outreach activities. (c) Validated need to address multiple threats to coral reefs in Honolua, especially from recreational overuse. (d) Identified additional partners, grants, and private funding.

Workshops and meetings with stakeholder groups were jointly funded by the various agencies that make up the steering committee. The steering committee has met regularly to organize workshops, meet with stakeholder groups, and develop the draft local action strategy. A draft local action strategy was presented to the U.S. Coral Reef Task Force in October 2003 and was available for over 2 months to stakeholder groups in Hawai`i for review and comment. This final local action strategy was completed by incorporating comments received from workshops with stakeholder groups as well as from the public review period. This final local action strategy is considered a "living document" that should be reviewed and updated annually by the steering committee and stakeholder groups based on accomplishments and new developments, and additional priority ahupua`a may be included in the strategy in the future.

Figure 1.1 Main Hawaiian Islands and Locations of Priority Ahupua`a

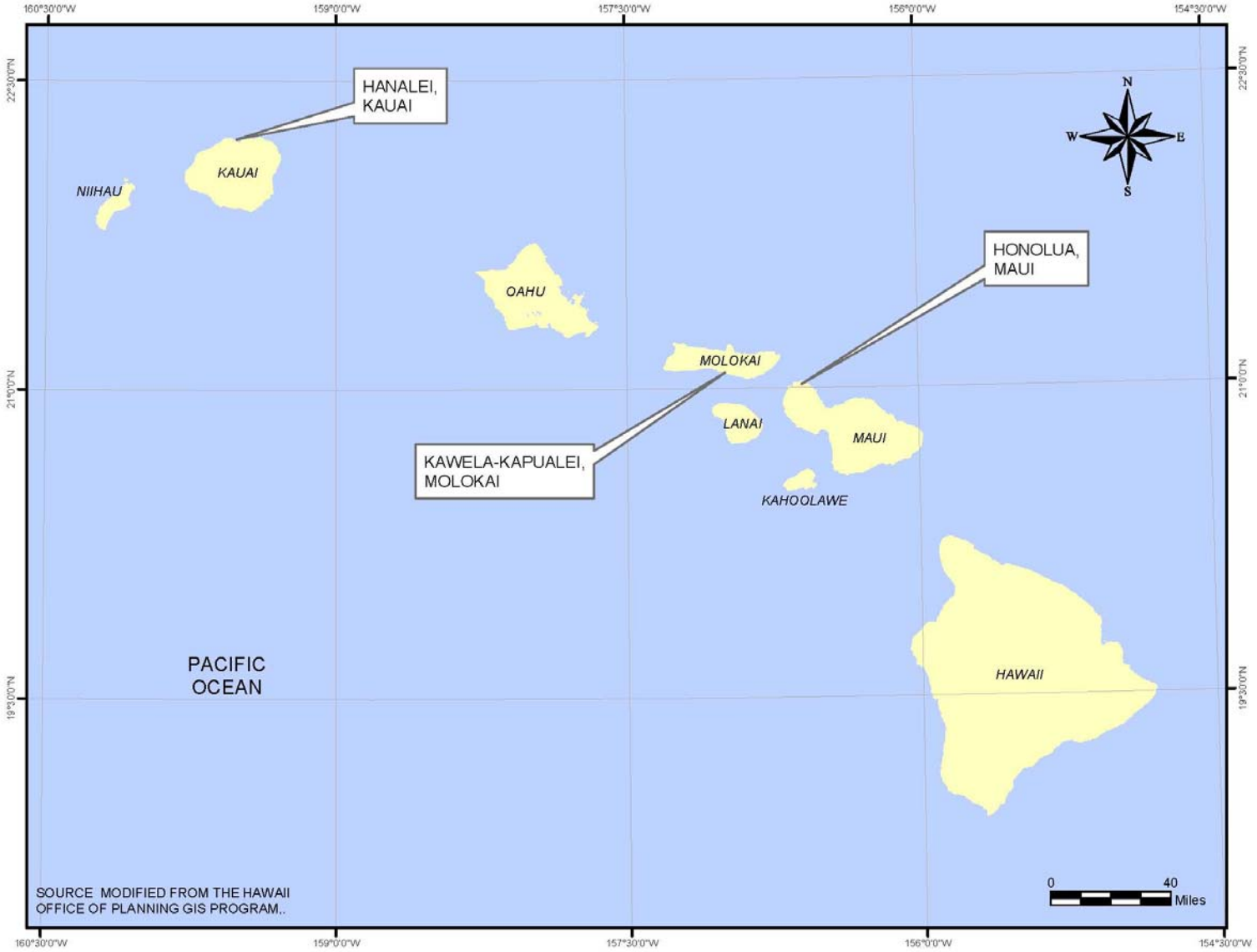
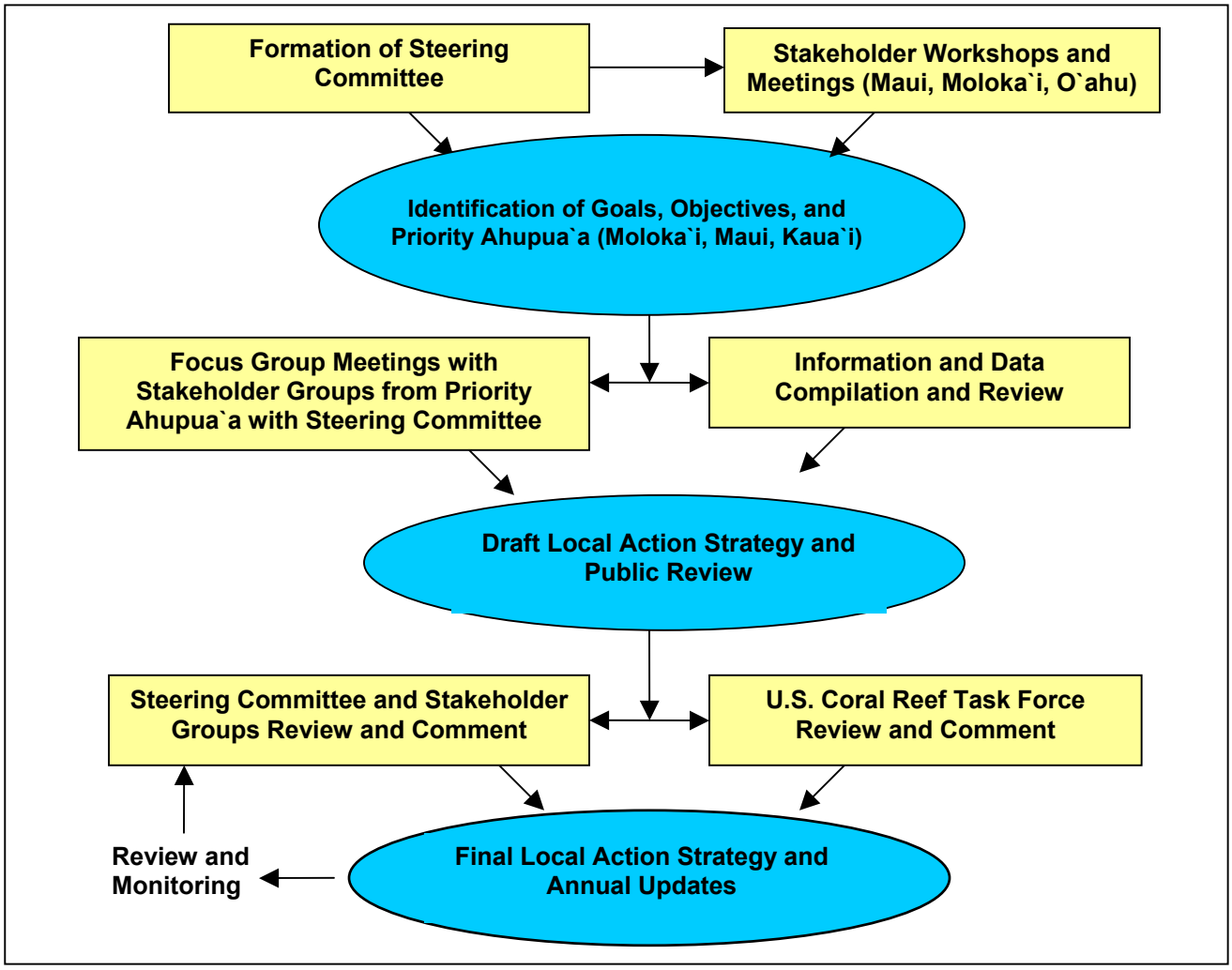


Figure 1.2 Collaborative Planning Process



1.2 Identification of Priority Ahupua`a for Focused Action

The steering committee, with stakeholder input, developed criteria to identify priority ahupua`a for focused action:

- Coral reef areas with potential impacts from land-based pollution sources
- High degree of stakeholder support and land-owner interest
- Presence of existing land management and pollution control activities

- Availability of baseline data on coral reef and water quality conditions

Eight geographic areas were identified as meeting these criteria as a result of consultations with coral reef scientists statewide and during the Hawai`i Scoping Workshop held in March 2003.

Geographic Areas Considered for Hawai`i's Local Action Strategy
1. West Maui (Honolua)
2. South Slope, Moloka`i (Kawela to Kamalo)
3. Hanalei, Kaua`i
4. Kihei Area, Maui
5. Kawaihae to Kohala Coast, Hawai`i
6. North Shore, O`ahu
7. Manele Bay, Lana`i
8. Kane`ohe Bay, O`ahu

After a series of meetings and workshops with stakeholders, the steering committee decided to initially focus on three priority areas for the development of local action strategies to address land-based pollution impacts on coral reefs: **Honolua, Maui; Kawela to Kapualei, Moloka`i; and Hanalei, Kaua`i**. Similarities and differences between these areas include:

- Varied existing and planned land uses, including land use change from pineapple cultivation to diversified agriculture, resort development and conservation (Honolua, Maui), existing mixed rural development and conservation land uses (Kawela to Kapualei, Moloka`i), and existing mixed urban agriculture, and rural development and conservation (Hanalei, Kaua`i)

- Different potential pollutants and sources, including from suspended solids from feral ungulates (Kawela to Kapualei, Moloka`i), bacterial contamination from cesspools adjacent to estuarine and coastal environments (Hanalei, Kaua`i), and suspended solids and nutrients from agricultural activities (Honolua, Maui and Hanalei, Kaua`i)

- Different trends in coral reef health characterized by declining coral cover (Honolua, Maui; Kawela to Kapualei, Moloka`i) and stable coral cover (Hanalei, Kaua`i)

- All three areas are located within the boundaries of the Hawaiian Islands Humpback Whale Sanctuary, with offshore waters of Moloka`i and Hanalei serving as calving areas for Humpback whales

Through group consultations with coral reef scientists and stakeholders, ongoing actions in each priority area were identified and documented. This documentation provided the context and background for defining the status of existing and funded programs and helped define new unfunded actions to fill gaps in addressing land-based pollution threats on coral reefs.

Additional priority areas for future consideration were identified during the public comment period and included south Maui and Kailua, O`ahu.

1.3 Goals, Objectives, and Measures of Success

Goals, objectives and measures of success for Hawai`i's local action strategy were identified to serve as a statewide guide for addressing land-based pollution threats to coral reefs. These goals and objectives were developed through an iterative process by the steering committee together with input from key stakeholder groups. The goals and objectives highlight the link between land-based pollution resulting from increased population and development, and the quality, function, and health of coastal ecosystems. Short-term and long-term measures of success provide benchmarks to gauge progress through an ongoing effort to continuously improve land use practices that can threaten the health of coral reef ecosystems.

Goals, Objectives, and Measures of Success to Address Land-Based Pollution Threats to Coral Reefs in Hawai`i

Goal: Reduce land-based pollution to improve coastal water quality and coral reef ecosystem function and health

Objective 1: Reduce pollutant load to surface water and groundwater through site-specific actions and best management practices

Objective 2: Improve our understanding of the links between land-based pollution and coral reef health through focused scientific research and monitoring

Objective 3: Increase awareness of pollution prevention and control measures statewide

Short-Term Measures of Success (3 years):

- Existing management actions and monitoring to address land-based pollution threats have been documented in three selected ahupua`a
- New actions with potential funding sources have been identified, packaged, and funded for implementation through collaborative stakeholder groups in selected ahupua`a and for research and monitoring
- Management decisions are informed by focused scientific research and monitoring
- Achievements and lessons learned in implementing local action strategies are documented and disseminated to serve as a catalyst for other ahupua`a

Long-Term Measures of Success (10 years):

- Pollutant loads to coastal waters in selected ahupua`a have decreased
- Impacts to reef ecosystems of the selected ahupua`a are reduced based on multiple indicators (e.g. increased living coral cover, reproduction, recruitment, and reduced algal cover)
- Pollution controls are developed and implemented in other areas of the State

1.4 Proposed Actions for Priority Funding

Actions proposed for priority funding include watershed-specific actions, statewide actions, and actions that address multiple threats. These proposed actions are listed in Table 1.1 and described in detail in subsequent sections as action plans for each ahupua'a and for statewide initiatives. The funding status of proposed actions is summarized in Appendix A.

The proposed actions for priority funding build on existing and significant ongoing actions and are intended to address funding gaps to implement best management practices, conduct research and monitoring, and continue the program, as described below:

- For Honolua, Maui, the most immediate need identified is a workshop to develop design recommendations for small-scale wastewater and stormwater management systems for public recreational infrastructure (restroom facility and parking lot) in a sensitive coastal environment. The proposed synthesis and analysis of the extensive data set collected by multiple investigators in the area is needed to provide a better understanding of the links between land-based pollution and coral reef health. Conclusions from the data analysis will serve as a baseline for a proposed study to evaluate the carrying capacity of this area for recreational use. The proposed carrying capacity study would address multiple threats to coral reef health, especially recreational overuse. Design parameters for the public recreational infrastructure would be evaluated such as the number, location, and design of mooring buoys to reduce coral impacts from boat anchors, possible limits on the number of people using the area per day, and capacity and size of parking and restroom facilities that would limit overuse.

- Priority actions proposed along the south slope of Moloka`i included funding best management practices to control feral ungulates and fire as part of the implementation of the Watershed Restoration Action Strategy for the South Coast of Moloka`i. These actions build significantly on the existing and extremely successful multi-pronged approach to feral animal control and address the other major soil erosion threat: fire.

- Funding is needed to complete the analysis of a 10-year data set on coral cover for Hanalei Bay, Kaua`i, which was not included in Hanalei's EPA Watershed Initiative Grant.

- Long-term monitoring is needed in all three ahupua`a, using indicators sensitive to land-based pollution impacts on coral reefs and consistent protocols.

- Statewide coordination and implementation support are needed to realize the goals and objectives of Hawai`i's local action strategy by assisting frontline implementers with technical and proposal development assistance, monitoring implementation of the local action strategy, and disseminating pollution prevention and control measures statewide.

Table 1.1 Proposed Actions for Priority Funding[1]

Proposed Action for FY 2004 Funding (Unfunded)	Potential Funding Source	Duration	Estimated Cost ($)
Goal: Reduce land-based pollution to improve coastal water quality and coral reef ecosystem function and health			
Objective 1: ***Reduce pollutant load to surface water and groundwater through site-specific actions and best management practices***			
Proposed Action 1A: Innovative Wastewater and Storm-Water Management System Workshop and Design Recommendations for Public Restroom Facility and Parking Lot in a Sensitive Coastal Environment (Honolua, Maui)	EPA, DOH, CZM, Private/NGO	6 months	$65,000
Proposed Action 1B: Soil Erosion and Surface Water Runoff Control for Land Use Transition from Pineapple Cultivation to Resort, Residential, and Recreational Development (Honolua, Maui)	EPA,DOH, NRCS, USACE, Private	3 years	$300,000
Proposed Action 1C: East Moloka`i Watershed Partnership – Phase II Fence Extension in Upper Watershed to Control Feral Animals (Kawela-Kapualei, Moloka`i)	EPA, NRCS DOH, FWS, Private/NGO	1 year	$250,000
Proposed Action 1D: East Moloka`i Watershed Partnership – Feral Animal Control Program Associated with Phase II Fence Extension (Kawela-Kapualei, Moloka`i)	EPA, NRCS DOH, Private/NGO	5 years	$670,000
Proposed Action 1E: East Moloka`i Watershed Partnership – Fire Task Force and Management Program (Kawela-Kapaulei, Moloka`i)	EPA, NRCS DOH, Private/NGO	5 years	$100,000
Proposed Action 1F: East Moloka`i Watershed Partnership – Sediment Basin Construction and Maintenance (Kawela-–Kapualei, Moloka`i)	EPA, NRCS, DOH	4 years	$2,000,000
Proposed Action 1G: Finalization, Approval, and Implementation of Watershed Restoration Strategy for the South Shore of Moloka`i (Kawela-Kapualei, Moloka`i)	EPA, NRCS, DOH, CZM	3 years	$150,000
Objective 2: ***Improve our understanding of the links between land-based pollution and coral reef health through focused scientific research and monitoring***			
Proposed Action 2A: Synthesis and Critical Analysis of Available Information on Land Use, Runoff, Water Quality and the Health of the Coral Reef Ecosystem at Honolua Bay (Honolua, Maui)	NOAA, HCRI, DLNR	6 months	$25,000
Proposed Action 2B: Carrying Capacity Study to Manage Public Use of Honolua Bay (Honolua, Maui)	MLP	6 months	$30,000
Proposed Action 2C: Analysis of 10-Year Data Set on Coral Cover in Hanalei Bay (Hanalei, Kaua`i)	USGS	6 months	$25,000
Proposed Action 2D: Regional Workshop to Develop Indicators and Protocols to Assess Coral Reef Health and Threats from Land-Based Pollution	NOAA, EPA, HCRI, USGS	3 months	$60,000
Proposed Action 2E: Long-Term Monitoring of Three Priority Ahupua`a Using Pollution-Impact-Sensitive Indicators (Honolua, Maui; Kawela-Kapualei, Moloka`i; Hanalei, Kaua`i)	NOAA, EPA, HCRI, USGS, DLNR	3 years	$600,000
Proposed Action 2F: Assessment of Coral and Fish Disease in Three Priority Ahupua`a in Relationship to Human Wastewater Loads (Honolua, Maui; Kawela-Kapualei, Moloka`i; Hanalei, Kaua`i)	DLNR, HCRI	1 year	$10,000
Objective 3: ***Increase awareness of pollution prevention and control measures statewide***			
Proposed Action 3A: Local Action Strategy Coordination, Implementation, and Monitoring	NOAA, EPA, DLNR, CZM, DOH, NRCS	3 years	$225,000
Proposed Action 3B: Workshop Series on Land-Based Pollution Threats to Coral Reefs	NOAA, EPA, DLNR, CZM, DOH, USGS	3 years	$50,000
		Total Estimated Funding Required	**$4,560,000**

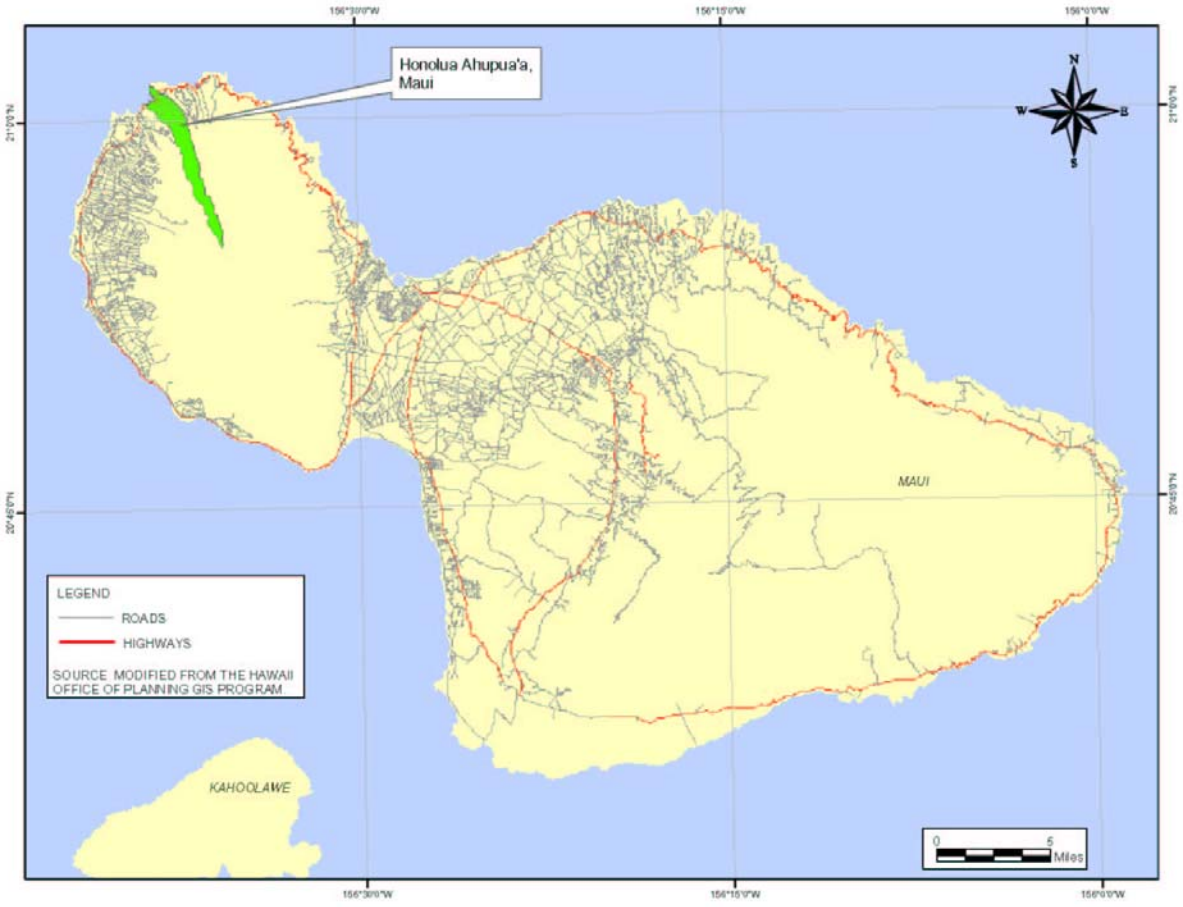
[1] Priority unfunded actions identified in 2003. Funding status of priority actions as of March 2004 is provided in Appendix A.

Section 2.0
Action Plan for Honolua, Maui

2.0 Action Plan for Honolua, Maui

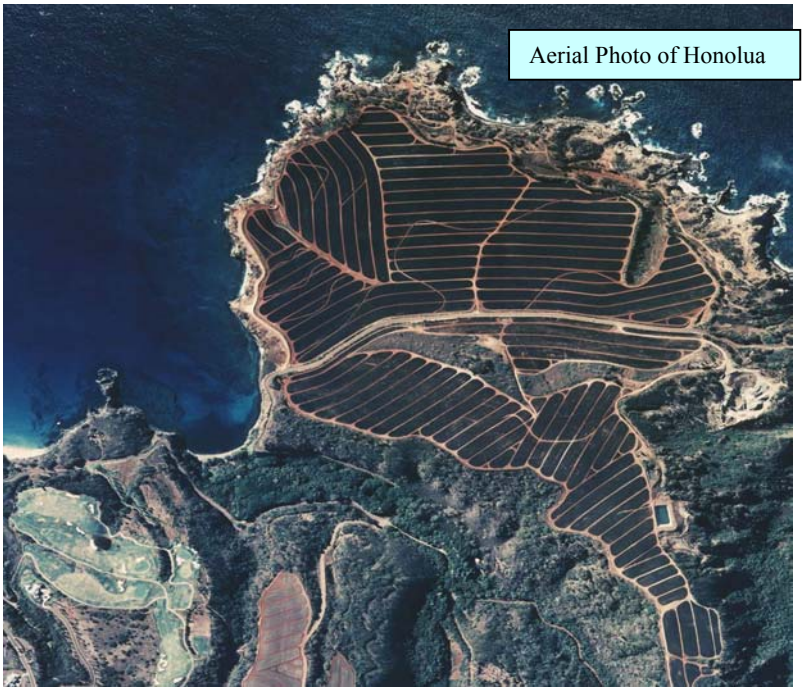
The Honolua ahupua`a is located approximately 10 miles north of Lahaina on the northwest tip of the island of Maui, Hawai`i. The watershed area covers the drainage area of Honolua Stream, Papua Gulch, and Pahiki Gulch, a land area of approximately 2,586 acres. This watershed drains into Honolua Bay, a 26.5-acre, semi-enclosed embayment bordered north and south by basaltic cliffs. Honolua Stream is approximately 7.5 miles long and is characterized as an interrupted perennial stream, with an estimated flow of about 5 million gallons per day at the upper elevations. Approximately 250,000 gallons per day is diverted to Honokohau Ditch at the 800-foot elevation for domestic and irrigation use Maui Land & Pineapple Company (MLPC 2003).

Figure 2.1 Location of Honolua Watershed, Maui



2.1 Land-Based Pollution Threats

Honolua watershed has a long history of diverse land uses that may have contributed to land-based pollution, including grazing, agriculture, activities of feral animals, and recreation uses. Historically, the Honolua watershed was used for cattle ranching and later diversified into agricultural crops such as coffee, corn, watermelon, and macadamia nuts. A golf course was operated at Lipoa Point until the 1930s; since the 1930s, however, pineapple has been the main crop grown in Honolua. Soil erosion control measures in agricultural lands have been installed by the Maui Land & Pineapple Company, the major land owner, with support from NRCS and DOH. Twenty-two soil erosion control structures were constructed between 1994 and 1996 including gradient terraces, filters, and sediment basins. Maui Land & Pineapple conducts annual water quality monitoring in Honolua Bay and has performed several coral reef assessments.



Aerial Photo of Honolua

In the 1970s and 1980s, The Nature Conservancy assessed the upper watershed of Honolua together with Maui Land & Pineapple Company. Feral pig activities were highlighted as a threat to native vegetation and a source of soil erosion. In 1988, The Nature Conservancy and Maui Land & Pineapple Company agreed to establish a conservation program to reduce the numbers of feral animals. In the 1990s, the partnership was expanded to become the West Maui Mountain Partnership, to include other private land owners, DLNR, and other government agencies. Implementation of strategic fencing, pig hunting, and snares has resulted in a tenfold decrease in pig numbers over the last 10 years (MLPC 2003).

The Honolua Watershed contains both State Conservation District and Agriculture District lands. The upper portions of the watershed are within the State Conservation District, which is managed by various reserves including the West Maui Natural Area Reserve, Pu`u Kukui Watershed Management Area, and the West Maui Forest Reserve. The upper portions near the summit at Pu`u Kukui are still relatively pristine native forest. Below the Conservation District, there is a mix of native and introduced ecosystems; alien vegetation and agriculture dominates at elevations below 1,500 feet. None of the lands in the Honolua Watershed are classified as "urban" land use. The West Maui Community Plan recommends preserving agricultural and conservation land uses.

Over the next few years, large scale pineapple cultivation in the watershed will be phased out. Maui Land & Pineapple Company, together with its sister company, Kapalua Land Company, plans to develop some of the land into a low-density resort and residential area with golf courses. Some portions of the watershed will remain agricultural, but the exact use has yet to be determined. In addition, Kapalua Land Company plans to improve public access and infrastructure for Honolua Bay and Lipoa Point by adding public hiking trails, restroom facilities, and a parking lot. With upcoming proposed changes in land use, numerous opportunities exist to continue public-private sector partnerships to address land-based pollution threats to coral reefs and improve our understanding of the impacts of different land uses and best management practices on reducing pollutant loads to coastal waters.

Potential land-based pollution threats in the Honolua ahupua`a may include the following:

- Soil erosion from feral ungulates in the upper watershed
- Surface water runoff from agriculture (mainly pineapple fields) is that transported through Honolua Stream and into the bay, carrying sediment, nutrients, and agricultural chemicals (Storlazzi et al., 2003a)
- Discharge of oil and grease, trash, and wastewater from a variety of recreational uses

2.2 Other Threats

The USCRTF has identified six priority threats to U.S. coral reefs: overfishing, lack of public awareness, recreational overuse, climate change, coral disease, and land-based pollution. In the Honolua ahupua`a, besides land-based pollution, priority threats to the coral reef ecosystem are recreational overuse, alien and invasive algal species, and illegal fishing.

Honolua Bay is a major recreational area for snorkelers and divers. The area lacks public restroom facilities, parking areas, permanent mooring buoys for boats, and other appropriate infrastructure to handle the high volume of recreational use. Improper solid waste disposal and release of oil and grease from recreational and tourist boats has also been identified as a concern.

Alien and invasive algal species are considered a major threat to coral reef ecosystems in Hawai`i (Davidson et al, 2003). Alien and invasive algal species documented in Honolua Bay include *Acanthorphora spificera* and *Hypnea musiformis* (Hunter 2000) and *Chrysocystis fragilis* (Dollar and Grigg, in press). Elevated nutrient levels may influence the proliferation of these species (Hunter 2000).

Honolua Bay, along with adjacent Mokuleia Bay, was designated as a Marine Life Conservation District, covering 45 acres of coral reef habitat. The bay is also included within the boundaries of the Hawaiian Islands Humpback Whale National Marine Sanctuary, approved by the U.S. Congress in 1997. Fishing is illegal inside the Marine Life Conservation District; however, numerous reports indicate that spearfishing and possibly other forms of fishing are occurring inside its boundaries.

2.3 Coral Reef Ecosystem Status

Numerous studies have been conducted on coral reef health and environmental conditions in Honolua Bay (Environmental Consultants, Inc. 1974; Torricer et al 1979; Grigg 1994; Brown 1999; Dollar and Grigg, in press; Brown 2003; Friedlander and et al 2003). In 1990, Kapalua Land Company initiated a marine biological and water quality monitoring program in Honolua Bay in response to concerns that shoreline development was causing negative impacts in the Bay (Dollar and Grigg, in press). Honolua Bay has been established as a long-term monitoring site for the Coral Reef Assessment and Monitoring Program (Jokiel et al, in press).

A comparison of temporal changes in coral cover in three sites along the west coast of Maui revealed that Honolua Bay was the only site exhibiting a long-term declining trend in coral cover as well as low coral recruitment rates (Brown 2003). A 33 percent decline in coral cover was reported throughout the entire bay based on an analysis of a long-term data set between 1992 and 2002 (Dollar and Grigg, in press). Periodic sedimentation events of various magnitude and duration may have resulted in cycles of damage and recovery that have produced a coral community that reflects intermediate disturbance and a coral community structure dominated by sediment-resistant species (Dollar and Grigg, in press). Poor flushing of inner Honolua Bay by restricted currents has resulted in prolonged trapping and deposition of sediment. In contrast, shallow sites (3 meters) monitored over a shorter time period (1999 to 2002) have revealed little change in coral cover (Jokiel et al, in press). Total coral cover at shallow sites in the northern and southern reefs in Honolua Bay was reported as 15 and 21 percent based on an analysis of CRAMP data (Friedlander et al 2003). Overall, researchers are observing a trend of declining coral cover; however, the likely causes of this decline are not obvious. A comprehensive review and comparison of different existing data sets and methodologies are needed to improve our understanding of the factors influencing coral reef ecosystem health in Honolua Bay.

2.4 Proposed and Ongoing Actions

The Honolua ahupua`a offers a unique opportunity to design and implement actions to address a major planned land-use change and to monitor associated changes in coral reef health. Potential new projects identified through stakeholder consultations include technical assistance in the design of innovative wastewater system alternatives, and storm-water management and studies to address the carrying capacity of Honolua Bay.

Maui Land & Pineapple Company, the private land owner, working together with State and federal government partners, has made significant management efforts to control feral animals and soil erosion in the upper watershed. With the West Maui Soil and Water Conservation District and DOH's Polluted Runoff Control Program, Maui Land & Pineapple Company also has implemented an array of innovative agriculture management practices in the middle watershed. In addition, Maui Land & Pineapple Company has provided support for long-term water quality monitoring of Honolua Bay. The U.S. Geological Survey (USGS), DLNR, and University of Hawai`i conduct ongoing studies and monitoring programs in the bay.

The following tables present proposed and ongoing actions to address land-based pollution threats to coral reefs in the Honolua ahupua`a. Table 2.1 summarizes the proposed (unfunded) and ongoing (funded) actions. Table 2.2 provides a detailed description of each proposed action, and Table 2.3 describes the ongoing actions. Appendix A provides the funding status of proposed actions.

Table 2.1 Honolua, Maui—Summary of Actions to Address Land-Based Pollution Threats on Coral Reefs

Threat/Focus Area: *Land-Based Pollution*
Goal: *Reduce land-based pollution to improve coastal water quality and coral reef ecosystem function and health*
Indicator: *Land-based pollution sources reduced in selected ahupua`a and statewide*

Proposed and Ongoing Actions	Type of Action					Action Status		
	Policy Reform	Best Management Practices	Technical Assistance	Research and Monitoring	Outreach and Education	Unfunded	Funded	Completed
Objective 1: *Reduce pollutant load to surface water and groundwater through site-specific actions and best management practices* **Indicator:** *No. of site-specific pollution prevention and control measures being implemented*								
Proposed Action: Innovative Wastewater and Storm-Water Management System Workshop and Design Recommendations for Public Restroom Facility and Parking Lot in a Sensitive Coastal Environment (**Priority Action 1A**; Honolua, Maui)		X	X			X		
Proposed Action: Soil Erosion and Surface Water Runoff Control for Land Use Transition from Pineapple Cultivation to Resort, Residential, and Recreational Development (**Priority Action 1B**; Honolua, Maui)		X	X			X		
Proposed Action: Technical Assistance for Stormwater Management for Residential and Golf Course Development at Honolua (Honolua, Maui)		X	X			X		
Proposed Action: Honolua Ecosystem Restoration Project (Honolua, Maui)		X	X	X		X		
Action 1.1 Soil Erosion Control Best Management Practices and Monitoring for Pineapple Cultivation (Honolua, Maui)		X					X	
Objective 2: *Improve our understanding of the links between land-based pollution and coral reef health through focused scientific research and monitoring* **Indicator:** *No. of management decisions informed by the results of focused scientific research and monitoring*								
Proposed Action: Synthesis and Critical Analysis of Available Data and Information on Land Use, Runoff, Water Quality, and the Health of Coral Reef Ecosystem at Honolua Bay (**Priority Action 2A**; Honolua, Maui)				X		X		
Proposed Action: Carrying Capacity Study for Managing Public Use of Honolua Bay (**Priority Action 2B**; Honolua, Maui)				X			X	
Proposed Action: Wave Energy and Sediment Suspension Gradients along Northwest Maui (Honolua, Maui)				X		X		
Proposed Action: Spatial and Temporal Variability in Historic Near-Shore Sedimentation Recorded in Coral Skeletons				X			X	
Action 2.1 Study of Anthropogenic and Natural Stresses on Coral Reefs (Honolua, Maui)				X				X
Action 2.2 Hawai`i Coral Reef Assessment and Monitoring Program (Honolua, Maui)				X			X	
Action 2.3 Study of Long-Term Variability of Currents, Temperature, Salinity and Turbidity off Kahana, Northwest Maui (Honolua, Maui)				X			X	
Action 2.4 West Maui Coastal Circulation Experiment (Honolua, Maui)				X			X	

Notes:

1. Yellow shading indicates actions proposed for priority (FY04) funding (see Table 1.1).
2. Proposed (unfunded) actions are described in Table 2.2, and ongoing (funded) actions are described in Table 2.3.
3. Priority unfunded actions identified in 2003. Funding status of priority actions as of March 2004 is provided in Appendix A.

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Figure 2.2. Locations of Actions Proposed for Priority Funding in Honolua, Maui

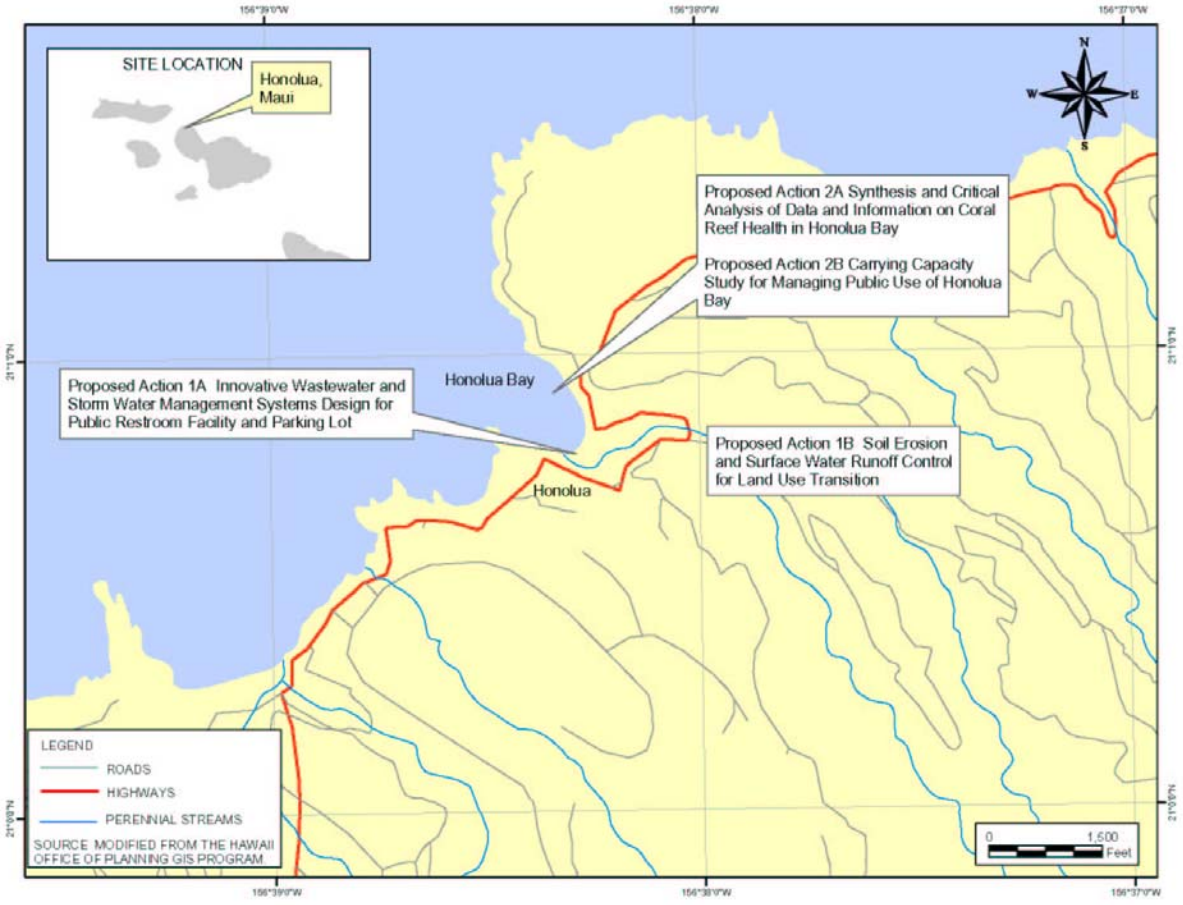


Table 2.2 Honolua, Maui—Detailed Description of Proposed (Unfunded) Actions

Actions Proposed for Priority Funding	
Proposed Action: Innovative Wastewater and Storm-Water Management Systems Workshop and Design Recommendations for Public Restroom Facility and Parking Lot in a Sensitive Coastal Environment (**Priority Action 1A**, Honolua, Maui)	
Description: Recreational use of Honolua Bay is extensive. Snorkeling and diving from shore and tour boats bring hundreds of tourists each day. Currently, no public restroom facility is available for use, and the area is not served by the Maui County sewerage system. Kapalua Land Company, the private land owner, plans to develop a public restroom facility and parking lot in the coastal strip adjacent to Honolua Stream to improve public access to Honolua Bay. Technical assistance has been requested to research and provide recommended design alternatives for the public restroom facility that will ensure wastewater does not seep into shallow groundwater and leach into coastal waters. In addition, innovative storm-water conveyance systems will be developed for the parking lot. This project could be packaged as a public-private sector partnership, where research on alternatives and technical assistance in design of a suitable wastewater system is supported by EPA or other federal agencies and construction is supported by Kapalua Land Company.	
Status: Unfunded	**Duration:** 6 months
Lead Organization: To be determined	**Partner Organizations:** Maui Land & Pineapple Company, Kapalua Land Company, EPA, DOH, ZCM
Estimated Cost: $65,000	**Potential Funding Sources:** MLPC, EPA, DOH, DLNR, CZM
Staff, Training & Technical Expertise Needs: Innovative wastewater design	**Significance of Expected Outputs:** Small-scale wastewater treatment systems developed for sensitive coastal areas lacking public sewerage; technology developed and applicable to Hanalei, Kaua`i, and other parts of Hawai`i and Pacific Islands
Proposed Action: Soil Erosion and Surface Water Runoff Control for Land Use Transition from Pineapple Cultivation to Resort, Residential, and Recreational Development (**Priority Action 1B**; Honolua, Maui)	
Description: Best management practices to control soil erosion and polluted surface water runoff will be identified and implemented through a critical period of land use transition from pineapple cultivation to resort, residential, and recreational development. Maui Land and Pineapple Company will cease pineapple cultivation in the Honolua watershed in 2005. Proposed new development projects includes: resorts, low density residential areas, conservation areas, and public recreational facilities. Over the years, Maui Land and Pineapple Company has implemented important soil erosion controls for pineapple cultivation. New soil erosion and stormwater management practices will be identified and implemented for the proposed changes in land use.	
Status: Unfunded	**Duration:** 2004-2007
Lead Organization: To be determined	**Partner Organizations:** NRCS, West Maui Soil and Water Conservation District, County of Maui, University of Hawai`i, DOH Polluted Runoff Control Program
Cost: $300,000	**Potential Funding Sources:** EPA, DOH, Maui Land & Pineapple Company, NRCS
Staff, Training, & Technical Expertise Needs: Innovative best management practices for stormwater management and construction runoff	**Significance of Outputs:** Building on previous soil erosion control measures implemented for pineapple cultivation, this action will ensure that the transition to resort development will minimize polluted surface water runoff.

Table 2.2 Honolua, Maui—Detailed Description of Proposed (Unfunded) Actions (Continued)

Actions Proposed for Priority Funding (Continued)	
Proposed Action: Synthesis and Critical Analysis of Available Data and Information on the Health of Coral Reef Ecosystem at Honolua Bay (**Priority Action 2A**; Honolua, Maui)	
Description: Assessment and monitoring of Honolua Bay is being conducted by a number of different research groups. Studies focus on factors influencing the health of the coral reef ecosystem in Honolua Bay. This proposed action would provide a venue for collaboration and cooperation by the different groups for the synthesis and critical analysis of all available data in the Honolua Bay ahupua`a.	
Status: Unfunded	**Duration:** 6 months
Lead Organization: University of Hawai`i	**Partner Organizations:** University of Hawai`i, Maui Land & Pineapple Company, NOAA, EPA, NRCS
Estimated Cost: $25,000	**Potential Funding Sources:** NOAA, HCRI, DLNR
Staff, Training & Technical Expertise Needs: None	**Significance of Expected Outputs:** This action will make full use of all data and information to improve our understanding of the factors influencing declining coral reef health at Honolua Bay
Proposed Action: Carrying Capacity Study for Managing Public Use of Honolua Bay (**Priority Action 2B**; Honolua, Maui)	
Description: Recreational use of Honolua Bay is extensive. Snorkeling and diving from shore and tour boats bring hundreds of tourists each day. Domestic and solid waste are land-based pollutant sources due to the lack of public facilities and services in the area. In addition, recreational overuse is considered a possible threat to coral reef function and health. Kapalua Land Company plans to develop the area to provide improved public access. A major physical control on the use of the area will be determined by the size of the parking lot proposed by Kapalua Land Company. A study of the carrying capacity of Honolua Bay is proposed to provide recommended restrictions on use of the Bay that can be translated into infrastructure measures to restrict access, such as the size of the parking lot and other facilities, and permanent boat moorings.	
Status: Unfunded	**Duration:** 6 months
Lead organization: To be determined	**Partner Organizations:** Maui Land and Pineapple Company, NOAA, EPA, University of Hawai`i
Estimated Cost: $30,000	**Potential Funding Sources:** MLP
Staff, Training & Technical Expertise Needs: Multidisciplinary team composed of marine scientists, engineers, and socioeconomists	**Significance of Expected Outputs:** This study will establish design parameters for public recreational infrastructure needed to reduce impacts of recreation use on coral reef health.

Table 2.2 Honolua, Maui—Detailed Description of Proposed (Unfunded) Actions (Continued)

Other Proposed Actions	
Proposed Action: Technical Assistance for Storm-Water Management for Residential and Golf Course Development at Honolua (Honolua, Maui)	
Description: Planned land use changes in the Honolua ahupua`a will require different best management practices for storm-water and wastewater management. This project could be packaged as a public-private sector partnership, where technical assistance on storm-water and wastewater management is supported by EPA, DOH, and Maui County, and implementation of best management practices is supported by the private developer.	
Status: Unfunded	**Duration:** 1 year
Lead Organization: To be determined	**Partner Organizations:** EPA, DOH, Maui County, Kapalua Land Company
Estimated Cost: $25,000	**Potential Funding Sources:** EPA
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** Public-private partnerships provide opportunities to improve land use practices and leverage limited resources.
Proposed Action: Wave Energy and Sediment Suspension Gradients Along Northwest Maui (Honolua, Maui)	
Description: This proposed action would examine wave climates around Hawai`i and define the character of winter (northwesterly) and summer (southerly) swell and dominant wind-waves (northeasterly/easterly) in order to initiate a comparison with evolving reef maps to improve understanding of why reefs are located where they are. Due to the variability of reef geometries studied, an understanding of the importance of wave processes on reefs will only develop after the acquisition of high-quality field data. The goals of this action are to (a) document waves and wave-induced sediment suspension on a coral reef, and (b) model waves and wave-induced forces on the reef system off West Maui, Hawai`i. Waves exert strong forces on the reef, often breaking and/or dislodging coral and transporting it landward and seaward. On the upper shoreface, waves are the primary mechanism by which sediment is mobilized and transported along the bed. Sediment suspension may also control reef development by abrading and killing new coral recruits, limiting reef growth even when wave-induced forces are not high enough to break or dislodge coral. This proposed action is to collect in situ measurements of tides, waves, and sediment suspension from four stations along a 10-km stretch of Northwest Maui to look at variations in the wave climate throughout the year and the effects of island shadowing on wave forces impinging upon the reef. These data will be compared to output from a wave modeling effort that investigated end-member wave regimes and were validated by NOAA deep-water buoys.	
Status: Unfunded	**Duration:** 9-12 months
Lead Organization: USGS	**Partner Organizations:** University of Hawai`i, State of Hawai`i Department of Aquatic Resources (DAR)
Estimated Cost: To be determined	**Potential Funding Sources:** USGS
Staff, Training & Technical Expertise Needs: Physical oceanography, coastal processes, coral reef ecology	**Significance of Expected Outputs:** This action would result in a detailed, quantitative understanding of the importance of wave processes on reef development.

Table 2.2 Honolua, Maui—Detailed Description of Proposed (Unfunded) Actions (Continued)

Other Proposed Actions (Continued)	
Proposed Action: Honolua Ecosystem Restoration Project (Honolua, Maui)	
Description: The focus of this action would be to reduce sediment deposition on coral reefs and to restore and improve the quality of the nearshore marine environment. Sediment basins are proposed as best management practices to capture sediment from the watershed before it is deposited in the nearshore marine environment. A preliminary restoration plan was completed by the U.S. Army Corps of Engineers (USACE) in July 2003 and would form the basis for this action.	
Status: Unfunded	**Duration:** 2003 – 2010
Lead Organization: USACE	**Partner Organizations:** DLNR, West Maui Mountains Watershed Partnership, NRCS, USFWS, County of Maui, West Maui Soil and Water Conservation District
Estimated Cost: $4,000,000 - $5,000,000	**Potential Funding Sources:** USACE Section 206 WRDA 1996 (PL-104-303, Aquatic Ecosystem Restoration)
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** Land-based actions will reduce polluted surface-water runoff to Honolua Bay and protect the Marine Life Conservation District.
Proposed Action: Screening Level Monitoring for Pesticides and Herbicides in Honolua Bay	
Description: Mass cultivation of pineapple generally requires fairly extensive use of pesticides and herbicides. The presence of these chemicals entering the marine environment has not been examined. Screening level monitoring would be conducted to determine the presence of pesticides and herbicides entering Honolua Bay.	
Status: Unfunded	**Duration:** 6 months
Lead Organization: To be determined	**Partner Organizations:** NOAA, EPA
Estimated Cost: $50,000	**Potential Funding Sources:** USGS, NOAA, DLNR
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** This action will provide data on the significance of pesticides as a contaminant in the marine environment
Proposed Action: Spatial and Temporal Variability in Historic Near-Shore Sedimentation Recorded in Coral Skeletons (Honolua, Maui)	
Description: Coral skeletons have long been used as environmental proxy records because the chemistry of the carbonate skeletons reflects seawater conditions at the time of skeletal deposition. Because terrestrial sediment and runoff alter seawater chemistry, sedimentation events should leave a signal in the coral skeleton or its associated matrix. The goals of this task are to (a) compare the skeletal chemistry of modern corals in sediment-laden and clear waters to identify an appropriate trace metal indicator that can be used as a proxy for sedimentation events in Hawai`i, and (b) apply these proxies to historical coral skeleton records (i.e. cores). The first phase of this study would consist of collecting small amounts of living corals from environmentally relevant sites in Hawai`i and analyzing the trace metal composition of the skeletons using ion microprobes and inductively coupled plasma mass spectrometry (ICP-MS). Those trace metals that show a high correlation between skeletal concentrations and abundance in terrigenous source material will be evaluated for use as sediment proxy indicators. The resulting proxies will then be applied to long-term historical records in the second phase of this study, which will utilize skeletal cores taken from large, long-lived coral colonies in environmentally relevant areas. The presence of the trace metal proxies will be used as an indicator of possible historical sediment events, and high-resolution temporal analysis of the cores will be conducted to determine the possible correlation between historical sediment events and coral growth rates.	
Status: Unfunded	**Duration:** 6 months
Lead Organization: To be determined	**Partner Organizations:** University of Hawai`i, USGS, University of California at Santa Cruz, DLNR
Estimated Cost: To be determined	**Potential Funding Sources:** USGS
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** The action will provide a proxy record of sediment loads in near-shore waters and allow the assessment of historical effects of sediment on coral growth rates.

Table 2.2 Honolua, Maui—Detailed Description of Proposed (Unfunded) Actions (Continued)

Other Proposed Actions (Continued)	
Proposed Action: Control of Alien Algae in Honolua Bay (Honolua, Maui)	
Description: Non-native species of algae, otherwise known as, alien algae, has been identified as a priority threat to Hawai`i's coral reefs. The primary purpose of this action is to identify and remove alien algae in Honolua Bay. Alien algae may be introduced to Hawai`i waters from the release of spores or fragments of algae in bilgewater, ship hulls, or in some cases, as a result of aquaculture activities. The distribution of alien algae in Hawai`i's coral reefs may be associated with port and harbor areas, disturbed marine environments, or areas with nutrient inputs from land-based activities. The red alien alga, *Acanthophora spicifera*, was recorded at Honolua Bay in 2000. Early identification and removal of alien algae is a key to successful eradication in localized areas of State waters.	
Status: Unfunded	**Duration:** 6 months
Lead Organization: To be determined	**Partner Organizations:** DLNR, NOAA, EPA, HCRI
Estimated Cost: $15,000	**Potential Funding Sources:** DLNR, NOAA, EPA, HCRI
Staff, Training & Technical Expertise Needs: Build on existing experience in alien algal control in Waikiki and other sites	**Significance of Expected Outputs:** Identification and removal of alien algae would reduce the magnitude of this threat to coral reefs in Honolua Bay.

Table 2.3 Honolua, Maui—Detailed Description of Ongoing (Funded) Actions

Action 1.1 Soil Erosion Control Best Management Practices and Water Quality Monitoring for Pineapple Cultivation and Monitoring (Honolua, Maui)	
Description: Because of problems with storm water runoff affecting a popular recreational area, the Maui Land & Pineapple Company, with support from NRCS, WMSWCD and DOH, completed 22 soil erosion control measures between 1994 and 1996, including construction of diversion ditches, filters, and sediment basins. Ongoing activities include maintenance of sediment basins and water quality monitoring.	
Status: Funded	**Duration:** 1994 to Present
Lead Organization: Maui Land & Pineapple Company	**Partner Organizations:** NRCS, West Maui Soil and Water Conservation District, County of Maui, University of Hawai`i, DOH Polluted Runoff Control Program
Cost: To be determined	**Funding Sources:** Maui Land & Pineapple Company, NRCS, DOH Polluted Runoff Control Program
Significance of Outputs: 22 soil erosion control measures were implemented; monitoring and maintenance are ongoing. Sediment basins are used effectively to minimize sediment transport to coastal waters.	**Lessons Learned:** Public-private sector partnership provided basis for collaborative action to address land-based pollution issues. Protocols and responsibility for maintenance of sediment basins are critical and should be developed early in the process.
Action 2.1 Anthropogenic and Natural Stresses on Coral Reefs (Honolua, Maui)	
Description: Time series data, including rainfall, coral cover, and nutrients collected from 1992 to 2002 were analyzed for trends in coral reef health. Mean coral cover in 2002 ranged from 19 to 62 percent. Coral cover decreased significantly from 1992 to 2002 along transects in the inner, protected portion of the Bay. Poor flushing of inner Honolua Bay by restricted wave-induced currents resulted in prolonged trapping of sediment.	
Status: Funded	**Project Duration:** 2002-2003
Lead Organization: University of Hawai`i (S. Dollar and R. Grigg)	**Partner Organizations:** None
Cost: To be determined	**Funding Sources:** HCRI
Significance of Outputs: One of the few time-series data sets on coral reefs in Hawai`i was compiled and analyzed.	**Lessons Learned:** Potential pollutant impacts to coral reefs in Hawai`i are more easily measured in protected embayments. Reefs on exposed open coastal shorelines are more rapidly flushed by waves and currents but remain subject to sediment scouring and potential but largely unstudied impacts from pollutants in groundwater seeps and polluted runoff.
Action 2.2 Hawai`i Coral Reef Assessment and Monitoring Program (Honolua, Maui)	
Description: The Hawai`i Coral Reef Assessment and Monitoring Program (CRAMP) was established to describe spatial and temporal variation in Hawai`i coral reef communities in relation to natural and anthropogenic factors. Sixty permanent reef sites have been monitored in the main Hawaiian Islands since 1999. Two shallow (3 meter) sites are monitored as part of CRAMP in north and south Honolua Bay. Coral cover at the north site was 15.3 (1999), 17.0 (2000), 15.1 (2001), and 14.1 (2002). Coral cover at the south site was 20.9 (1999), 26.9 (2000), 23.1 (2001), and 23.9 (2002). No significant change in coral cover at this shallow depth was reported over this time period.	
Status: Funded/Ongoing	**Project Duration:** 1998-Present
Lead Organization: University of Hawai`i (P. Jokiel)	**Partner Organizations:** Hawai`i State Department of Aquatic Resources
Cost: To be determined	**Funding Sources:** HCRI, USGS, National Ocean Service, EPA Office of Water Quality, NOAA, USCRTF National Monitoring program, DAR, KIRC, and NARS
Significance of Outputs: Establishment of a long-term monitoring program for coral reefs in Hawai`i	**Lessons Learned:** A regular monitoring program is needed to identify long-term changes in coral reef health.

Table 2.3 Honolua, Maui—Detailed Description of Ongoing (Funded) Actions (Continued)

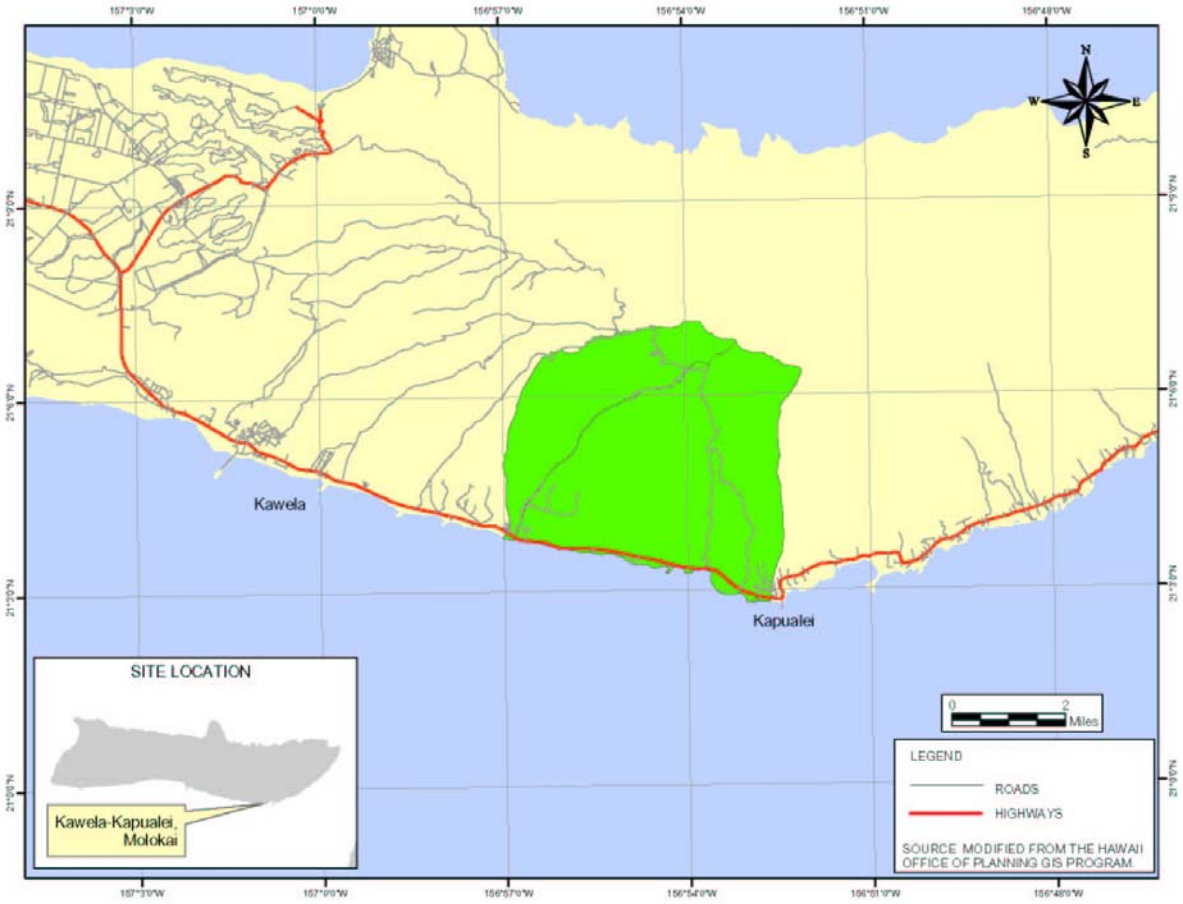
Action 2.3 Long-Term Variability of Currents, Temperature, Salinity, and Turbidity off Kahana, Northwest Maui (Honolua, Maui)	
Description: Long-term (15 months), high-resolution measurements of currents, temperature, salinity and turbidity were made off Northwest Maui in 2001-2003 to better understand coastal dynamics in coral reef habitats. Measurements were made through the deployment of a series of bottom-mounted instruments in water depths less than 10 m. The purpose of these measurements was to collect hydrographic data to better constrain the nature of how currents and water column properties such as water temperature, salinity, and turbidity in the vicinity of near-shore coral reef systems vary seasonally over the course of a year.	
Status: Funded	**Project Duration:** 4 months
Lead Organization: USGS	**Partner Organizations:** University of Hawai`i, DAR, Maui Ocean Center
Cost: $75,000	**Funding Sources:** USGS
Significance of Outputs: The only known long-time-series process data off Northwest Maui was compiled and analyzed. The combination of long-term but spatially limited time-series measurements provided new insight into the governing shelf dynamics in this complex setting over a range of temporal scales.	**Lessons Learned:** Over scales of months to a year, the influence of seasonal wind forcing and large-scale hydrography on circulation patterns and particulate flux was identified over the inner shelf (<20 m). These measurements show limited evidence of internal tidal bores that drive cooler, deep water onto the inner shelf. Large waves typically resuspended fine terrestrial sediment on the inner reef flat, which was then carried offshore and then driven downcoast by trade wind wave-induced currents.
Action 2.4 West Maui Coastal Circulation Experiment (Honolua, Maui)	
Description: The purpose of this experiment was to collect hydrographic data to better constrain the nature of how currents and water column properties such as water temperature, salinity and turbidity in the vicinity of nearshore coral reef systems vary over relatively large (~20 km) spatial scales. Small boat surveys and bottom-mounted instrument packages were used in combination to better understand the transport mechanisms of sediment, larvae, pollutants and other particulate matter in coral reef settings.	
Status: Funded	**Project Duration:** 4 months
Lead Organization: USGS	**Partner Organizations:** University of California at Santa Cruz, University of Washington, University of Hawai`i, DAR, Maui Ocean Center
Cost: $80,000	**Funding Sources:** USGS
Significance of Outputs: The only known spatially extensive, three-dimensional high-resolution process data along the coral reefs off West Maui was compiled and analyzed. The spatially extensive but temporally-limited small-boat surveys and multiple instrument packages provided new insight into the governing shelf dynamics in this complex setting over a range of temporal and spatial scales.	**Lessons Learned:** Over large spatial scales of km to tens of km, eddies and shear fronts were correlated with the presence or absence of coral reefs. Over the course of tidal cycles, the influence of tidal forcing and large-scale hydrography on circulation patterns and particulate flux over more than 10 km the inner shelf (<20 m) was identified. The rapid movement (< 24 hours) of water masses between islands was confirmed. This rapid movement would permit inter-island seeding of reefs or transport of pollutants, which has important implications for defining Marine Protected Areas.

Section 3.0
Action Plan for Kawela to Kapualei, Moloka`i

3.0 Action Plan for Kawela to Kapualei, Moloka`i

The focal area for actions to address land-based pollution threats to coral reefs in Moloka`i is located along the south shore and includes the watersheds of Kawela, Kamalo, and Kapualei and the Kamakou Preserve.

Figure 3.1. Watersheds of the East Moloka`i Watershed Partnership

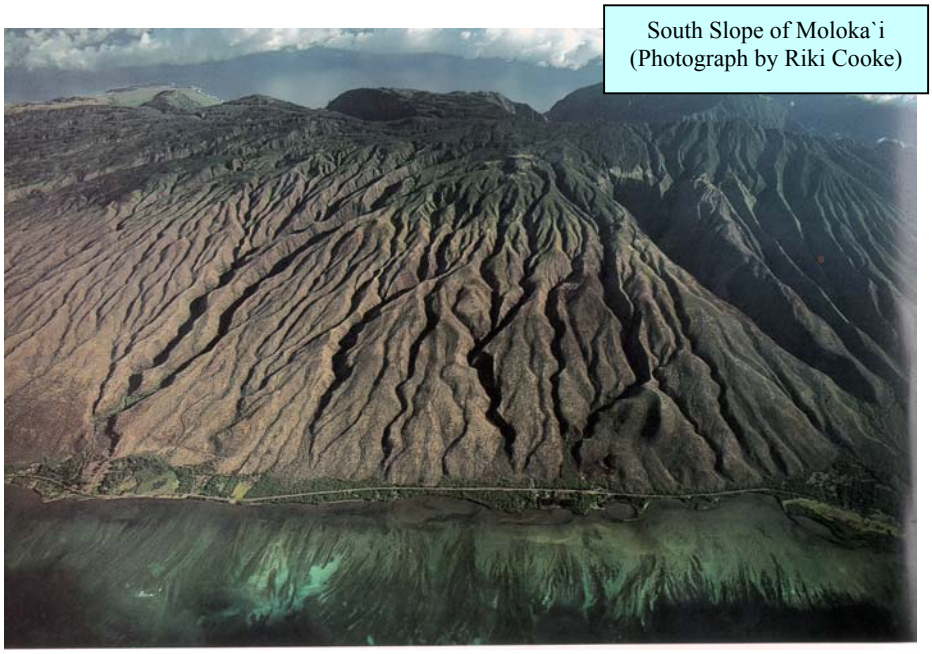


The Kawela ahupua`a is about 5,500 acres. At one time, Moloka`i Ranch owned about 90 percent of the Kawela ahupua`a. Today, the Ranch retains title only to the upper portions, which has been established as a perpetual conservation easement through The Nature Conservancy's Kamakou Preserve. The U.S. Fish and Wildlife Refuge Kakahaia Pond is located at the coast. In ancient times, Kawela was a thriving village with rich near-shore reefs and abundant springs.

Kamalo is dominated by a steep canyon, 1,500 feet deep and over a half-mile wide at its head. Kamalo is owned by Kamehameha Schools Bishop Estate. Kapualei comprises a series of

steep gulches and ridges east of Kamalo Canyon. The steep ridges culminate at the highest peak on Moloka`i: Kamakou (4,974 feet). Like Kamalo, the upper reaches of Kapualei have remained relatively unexplored. The Kapualei Ranch, Austin Estate, owns Kapualei. Together these two ahupua'a encompass about 5,000 acres. The upper zone, above 3,500 feet in elevation, contains some of the best remaining native Hawaiian forests, which once covered the entire mountain region of East Moloka`i. This area is home to hundreds of endemic Hawaiian plant and animal species.

In December 1998, Moloka`i was designated as an Enterprise Community. The federal Empowerment Zone/Enterprise Community Program (EZ/EC) was developed to afford communities opportunities to revitalize economic development and develop sustainable communities through community participation guided by a strategic vision for change (www.ezec.gov). Moloka`i Enterprise Community partners are implementing numerous and successful projects on jobs creation, job training and placement for youth, and community involvement. (EZ/EC 2002; 2000).



South Slope of Moloka`i
(Photograph by Riki Cooke)

3.1 Land-Based Pollution Threats

The major land-based pollution threat along the south coast of Moloka`i is suspended solids from soil erosion in watershed areas and sedimentation in the near-shore reef flat environment. Goats and fire are major factors contributing to soil erosion along the south slope of Moloka`i.

Reef Flat Along the South Coast of Moloka`i
(Photograph by Ed Misaki)

Near-shore waters along the south coast of Moloka`i are included on Hawai`i's 2002 303(d) list of impaired waters due to regular exceedance of water quality standards for nutrients, turbidity, and suspended solids (DOH 2002).

Impaired Water Bodies of South Moloka`i Listed under Section 303 (d) of the Clean Water Act					
Listed Water Body	**Geographic Scope of Listing**	**Pollutant(s)**	**Basis for Listing**	**Standard**	**Priority**
South Moloka`i Coast	Near-shore waters to 18 feet from southwest point – (Waialua)	Nutrients Turbidity Suspended Solids	Prior	-	Low

3.2 Other Threats

Alien and invasive algal species are considered a major threat to coral reef ecosystems in Hawai`i (Davidson et al, 2003). Alien and invasive algal species, including *Acanthophora spicifera*, *Gracilaria salicornia*, and *Hynea musiformis* have been recorded along the south shore of Moloka`i (Hunter 2000). Other threats have yet to be prioritized along the south shore of Moloka`i.

3.3 Coral Reef Ecosystem Status

Moloka`i has the largest continuous fringing coral reef in Hawaiian waters, extending approximately 30 miles along the southern and eastern coasts of the island. Nearshore reef flat environments are heavily impacted by sedimentation, and studies by the USGS indicate that terrigenous sediment deposited in the reef flat environment is effectively trapped and resuspended on a daily basis in response to tidal and wind energy (Field 2003). Offshore fringing reefs have high coral cover and are generally healthy. Little is known about the extent and impacts of nutrients along this shore. The south shore of Moloka`i is included in the Hawaiian Islands Humpback Whale National Marine Sanctuary approved by the U.S. Congress in 1997.

A number of studies have been conducted on coral reef health, marine geomorphology and sedimentation along the south shore of Moloka`i (Jokiel et al in press; Friedlander et al 2003; Carr and Nipper 2003; D'Iorio 2003; Storlazzi et al 2003b; Calhoun and Field 2002; and Cochran et al 2002). Kamalo Harbor has been established as a long-term monitoring site for the Coral Reef Assessment and Monitoring Program (Jokiel et al, in press). Significant decreases in coral cover have been reported just to the west of Kamalo Harbor shallow (3 m) and deep (10 m) sites over the period 2000 to 2002 (Jokiel et al, in press). Total coral cover at shallow sites (3 m) and deep (10 m) sites off Kamalo was reported as 3.6 and 0.8 percent, respectively, based on an analysis of CRAMP data (Friedlander et al 2003). Declining coral cover appears to be attributed to extensive sedimentation.

3.4 Proposed and Ongoing Actions

The "Watershed Restoration Action Strategy" (WRAS) for the south shore of Moloka`i was developed in August 2002 by the Moloka`i-Lana`i Soil and Water Conservation District (MLSWCD) to serve as a plan of action for a range of priority actions to decrease nonpoint source pollution (MLSWCD, 2002). A watershed advisory group was established to assist in strategy development and planning.

Significant efforts to control feral ungulates have been undertaken by The Nature Conservancy together with the DLNR, MLSWCD, and private land owners. The USGS and University of Hawai`i have ongoing studies and monitoring programs in the area. Proposed actions are designed to implement the WRAS, building on and strengthening effective, community-based initiatives to reduce land-based pollution to improve coastal water quality and coral reef function and health.

The following tables present proposed and ongoing actions to address land-based pollution threats to coral reefs in the Kawela to Kapualei ahupua`a. Table 3.1 summarizes the proposed (unfunded) and ongoing (funded) actions. Table 3.2 provides a description of each proposed action, and Table 3.3 describes the ongoing actions. Appendix A provides the funding status of proposed actions.

Table 3.1 Kawela to Kapualei, Moloka`i—Summary of Actions to Address Land-Based Pollution Threats on Coral Reefs

Threat/Focus Area: *Land-Based Pollution*
Goal: *Reduce land-based pollution to improve coastal water quality and coral reef ecosystem function and health*
Indicator: *Land-based pollution sources reduced in selected ahupua`a and statewide*

Proposed and Ongoing Actions	Type of Action					Action Status		
	Policy Reform	Best Management Practices	Technical Assistance	Research and Monitoring	Outreach and Education	Unfunded	Funded	Completed
Objective 1: *Reduce pollutant load to surface water and groundwater through site-specific actions and best management practices* **Indicator:** *No. of site-specific, pollution prevention and control measures being implemented*								
Proposed Action: East Moloka`i Watershed Partnership – Phase II Fence Extension in Upper Watershed to Control Feral Animals (**Priority Action 1C**; Kawela-Kamalo, Moloka`i)		X				X		
Proposed Action: East Moloka`i Watershed Partnership – Feral Animal Control Program Associated with Phase II Fence Extension (**Priority Action 1D**; Kawela-Kapualei, Moloka`i)		X				X		
Proposed Action: East Moloka`i Watershed Partnership - Fire Task Force and Management Program (**Priority Action 1E**; Kaunakakai-Kawela, Moloka`i)		X				X		
Proposed Action: East Moloka`i Watershed Partnership - Sediment Basin Construction and Maintenance (**Priority Action 1F**; Kawela-Kapualei, Moloka`i)		X				X		
Proposed Action: Finalization, Approval, and Implementation of the Watershed Restoration Action Strategy for the South Shore of Moloka`i (**Priority Action 1G**; Kawela-Kapualei, Moloka`i)		X	X	X	X	X		
Action 1.1 East Moloka`i Watershed Partnership – Phase I Feral Animal Control Program (Kawela-Kapualei, Moloka`i)		X					X	
Action 1.2 Development of the Watershed Restoration Action Strategy for the South Shore of Moloka`i	X	X	X	X	X			X
Objective 2: *Improve our understanding of the links between land-based pollution and coral reef health through focused scientific research and monitoring* **Indicator:** *No. of management decisions informed by the results of focused scientific research and monitoring*								
Proposed Action: East Moloka`i Watershed Partnership – Monitoring Program to Assess Effectiveness of Soil Erosion Control Measures (Kawela-Kapualei, Moloka`i)				X		X		
Action 2.1 Long-Term Temporal Variability in Sediment Transport Patterns on the Fringing Reef Flat off South-Central Moloka`i				X			X	
Action 2.2: Across-Reef Water and Suspended Sediment Flux Experiment: South-Central Moloka`i				X			X	
Action 2.3 Spatial Variability in Sediment Transport Patterns on a Fringing Reef: South-Central Moloka`i				X			X	

Notes:

1. Yellow shading indicates actions proposed for priority (FY04) funding (see Table 1.1).
2. Proposed (unfunded) actions are described in Table 3.2, and ongoing (funded) actions are described in Table 3.3.
3. Priority unfunded actions identified in 2003. Funding status of priority actions as of March 2004 is provided in Appendix A.

Figure 3.2 Locations of Proposed Actions and Best Management Practices for Kawela to Kapualei, Moloka`i

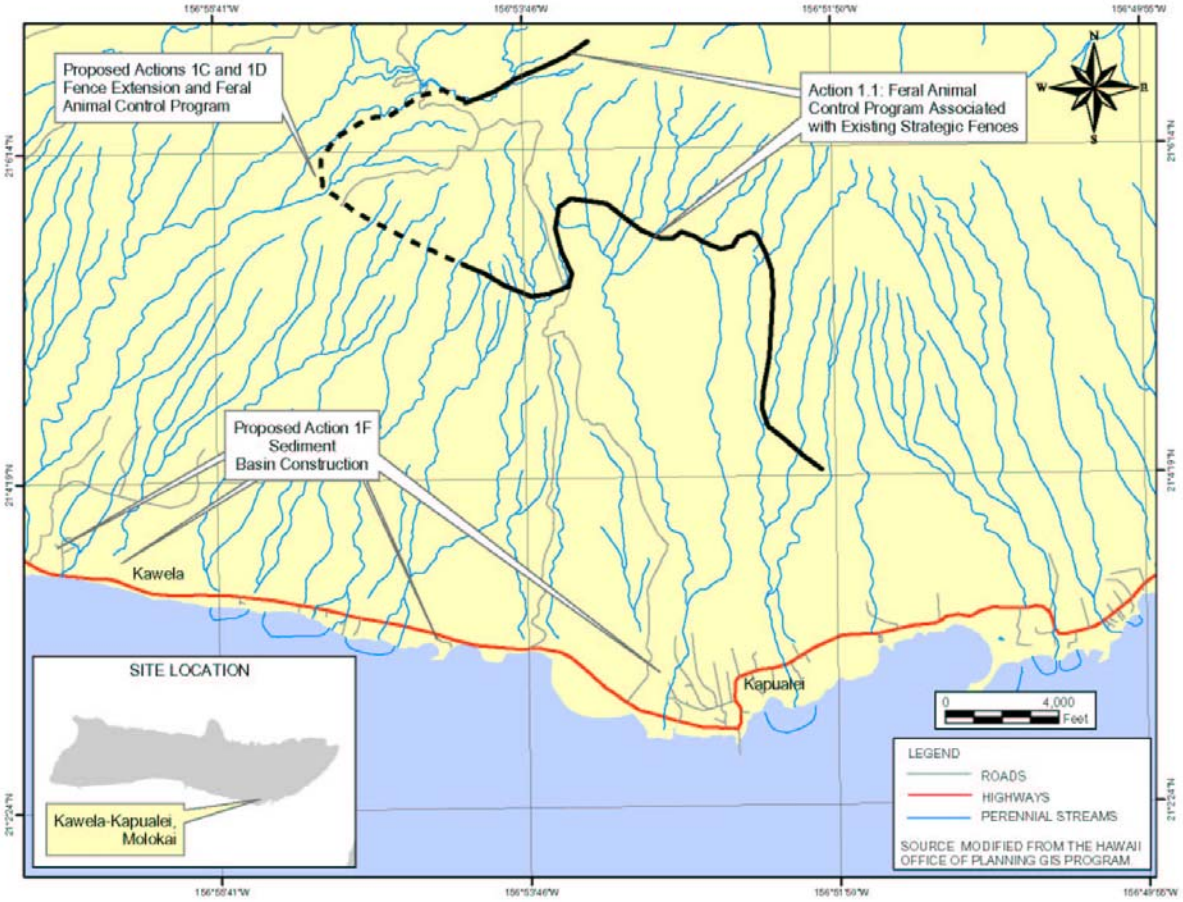


Table 3.2 Kawela to Kapualei, Moloka`i—Detailed Description of Proposed (Unfunded) Actions

Actions Proposed for Priority Funding	
Proposed Action: East Moloka`i Watershed Partnership – Phase II Fence Extension in Upper Watershed to Control Feral Animals (**Priority Action 1B**; Kawela-Kapualei, Moloka`i)	
Description: Feral animals (mainly goats) in the upper watershed areas of south Moloka`i are major contributors to soil erosion and destruction of native vegetation. Feral animal control, through strategic fencing, hunting, trapping, and aerial shooting, is considered a vital best management practice to reduce sediment load to surface water. In 2001, The Nature Conservancy (TNC) together with private land owners under the East Moloka`i Watershed Partnership (EMoWP) completed 5.5 miles of strategic fencing in the upper watershed. This proposed action involves fencing to extend the Kamalo/Kapualei fence along the Kawela contour and then up to the end of the Kamakou East Boundary Fence.	
Status: Unfunded	**Duration:** 1 year
Lead Organization: TNC	**Partner Organizations:** EMoWP, DLNR, NRCS, Kawela Plantation Homeowners Association, Kamehameha Schools, Kapualei Ranch, MLSWCD, new Makolelau land owner
Estimated Cost: $250,000	**Potential Funding Sources:** EPA, TNC, DLNR DOH, Natural Area Reserve System Fund, Maui County Board of Water Supply, Maui County Office of Economic Development, USDA Enterprise Community, USFWS Partners Program, NRCS Wildlife Habitat Incentive Program, Maui County Department of Public Works
Staff, Training & Technical Expertise Needs: Expertise available on island	**Significance of Expected Outputs:** The extension of the fencing will provide the last link in protecting a vital native forest from destruction by feral animals by connecting the two fences (approximately 2,500 acres) closing off major acreages to feral goats. EMoWP has served as an effective partnership for conservation efforts by leveraging funds across multiple land owners.
Proposed Action: East Moloka`i Watershed Partnership – Feral Animal Control Program Associated with Phase II Fence Extension (**Priority Action 1C**; Kawela-Kapualei, Moloka`i)	
Description: Feral animal control associated with the fence extension includes (1) fence maintenance and improvement, (2) aerial shooting to reduce goat population (1,500 every 2 years), (3) helicopter-assisted hunts to reduce goat population (500 per year), (4) pig hunting and trap-and-bait program in upper areas, (5) weed control activities, and (6) monitoring (feral animal surveys, vegetation, weather data).	
Status: Unfunded	**Duration:** 5 years
Lead organization: TNC	**Partner Organizations:** EMoWP, DLNR, NRCS, Kawela Plantation Homeowners Association, Kamehameha Schools, Kapualei Ranch, MLSWCD, new Makolelau land owner
Estimated Cost: $670,000	**Potential Funding Sources:** EPA, DOH, NRCS Wildlife Habitat Incentive Program, TNC, DLNR Natural Area Reserve System Fund, Maui County Board of Water Supply, Maui County Office of Economic Development, USDA Enterprise Community, USFWS Partners Program, Maui County Department of Public Works
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** Feral animal control is considered a vital BMP to reduce sediment load to surface water. Feral Animal Control Program is required in association with the fence.

Table 3.2 Kawela to Kapualei, Moloka`i—Detailed Description of Proposed (Unfunded) Actions (Continued)

Actions Proposed for Priority Funding (Continued)	
Proposed Action: East Moloka`i Watershed Partnership - Fire Task Force and Management Program (**Priority Action 1D**; Kaunakakai-Kawela, Moloka`i)	
Description: Fire management is critical for the south slope of Moloka`i. Fires in 1988, 1991, and 1998 consumed more than 10,000 acres each and resulted in increased sedimentation during the subsequent winter rains. Fire also displaces native vegetation, as fire-adapted non-native species quickly revegetate burned areas. In recent years, fires have had devastating effects, denuding large land areas and increasing soil erosion. Improved fire infrastructure and coordination between fire authorities and community groups is needed to develop a comprehensive fire management program. This proposed action includes: (1) establishment of a Fire Task Force to plan suppression and response strategies for fires in the watershed areas along south Moloka`i for improved coordination and response and support of plan, (2) improvement of fire management infrastructure (improving present roads and adding contour roads and fire breaks) along key south slope areas, and (3) a maintenance program for fire management infrastructure.	
Status: Unfunded	**Duration:** 5 years
Lead Organization: Moloka`i Fire Department	**Partner Organizations:** MLSWCD, Moloka`i Fire Department, Maui County Fire Commission, DLNR Division of Forestry and Wildlife
Estimated Cost: $100,000	**Potential Funding Sources:** EPA; NRCS, DOH, TNC, DLNR Natural Area Reserve System Fund, Maui County Board of Water Supply, Maui County Office of Economic Development, USDA Enterprise Community, USFWS Partners Program, Maui County Department of Public Works
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** More effective suppression of fires; Moloka`i south slope will be compartmentalized to enable more effective fire suppression within fire infrastructure compartments rather than over the entire slope. Project designed to get resources to help fire authorities suppress fires more effectively.
Proposed Action: East Moloka`i Watershed Partnership - Sediment Basin Construction and Maintenance (**Priority Action 1E**; Kawela-Kapualei, Moloka`i)	
Description: Sediment basins have proven to be effective best management practices to control sediment runoff to coastal areas. Sediment basins capture suspended solids in surface water runoff, reducing the sediment load to coastal water. A total of four sediment basins are proposed in strategic areas between Kawela and Kamalo to control sediment runoff to the reef flat environment.	
Status: Unfunded	**Duration:** 4 years
Lead organization: Moloka`i-Lana`i Soil and Water Conservation District	**Partner Organizations:** NRCS, TNC, EMoWP, private land owners, USFWS
Estimated Cost: $2,000,000	**Potential Funding Sources:** EPA, NRCS, DOH, TNC, DLNR Natural Area Reserve System Fund, Maui County Board of Water Supply, Maui County Office of Economic Development, USDA Enterprise Community, USFWS Partners Program, Maui County Department of Public Works
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** The proposed basins will be the first sediment basins in Moloka`i and will reduce the present sedimentation rate on reef. They also provide a possible soil recycling and revenue generation mechanism.

Table 3.2 Kawela to Kapualei, Moloka`i—Detailed Description of Proposed (Unfunded) Actions (Continued)

Actions Proposed for Priority Funding (Continued)	
Proposed Action: Finalization, Approval and Implementation of the Watershed Restoration Action Strategy for the South Shore of Moloka`i (**Priority Action 1F**; Kawela-Kapualei, Moloka`i)	
Description: The Watershed Restoration Action Strategy (WRAS) for the South Shore of Moloka`i was completed in August 2002 by Moloka`i-Lana`i Soil and Water Conservation District, with extensive community participation through the establishment of the Watershed Advisory Group. The WRAS defines activities to achieve two key objectives: • Establish a structured community that has an understanding of the resource concerns and is committed to the identified vision and goals to achieve restoration results of watersheds on the South Shores of Moloka`i. • Reduce nonpoint source pollution and erosion rate of South Moloka`i through installation or implementation of conservation practices and BMPs and other identified activities. Activities to address these objectives include: • Review and evaluate information and data pertaining to activities to restore, enhance, and maintain healthy watersheds on the South Shores of Moloka`i with economic and environmental viabilities. • Continue Kamalo-Kapualei fencing and feral animal control project westward to Kaunakakai • Develop a fire suppression/control plan for the South Moloka`i area • Reduce sedimentation and other identified pollutants flowing directly into or impacting ocean waters • Restore streambanks and develop riparian buffers • Plan and implement a comprehensive waste management program This proposed action will provide support to finalize the WRAS for DOH approval and for implementation in cooperation with the East Moloka`i Watershed Partnership.	
Status: Unfunded	**Duration:** 3 years
Lead organization: MLSWCD	**Partner Organizations:** EMoWP, TNC, USGS
Estimated Cost: $150,000	**Potential Funding Sources:** NRCS, EPA
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** The WRAS provides the community organizational aspects needed to implement specific actions to control land-based pollution.
Other Proposed Actions	
Proposed Action: East Moloka`i Watershed Partnership – Monitoring Program to Assess Effectiveness of Soil Erosion Control Measures (Kawela-Kapualei, Moloka`i)	
Description: Monitoring is needed to measure changes resulting from best management practices implemented under the East Moloka`i Watershed Partnership. Monitoring programs will measure vegetation recovery, feral animal removal, changes in sediment loading to the reef flat environment, and climatic trends. Sediment load in interrupted perennial streams will be measured using automated sampling equipment. Community-based monitoring teams will assist with all aspects of the monitoring program.	
Status: Unfunded	**Duration:** 5 years
Lead organization: To be determined	**Partner Organizations:** EMoWP, TNC, USGS, MLSWCD
Estimated Cost: $50,000	**Potential Funding Sources:** EPA; TNC, DLNR Natural Area Reserve System Fund, Maui County Board of Water Supply, Maui County Office of Economic Development, USDA Enterprise Community, USFWS Partners Program, NRCS Wildlife Habitat Incentive Program, Maui County Department of Public Works
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** Baseline data will be collected in order to assess changes resulting from implementation of the East Moloka`i Watershed Partnership. This is essential for assessing the effectiveness of management interventions.

Table 3.2 Kawela to Kapualei, Moloka`i—Detailed Description of Proposed (Unfunded) Actions (Continued)

Other Proposed Actions (Continued)	
Proposed Action: Assessment of Nutrient Impacts on Reef Flat Ecosystem and Develop Appropriate Nutrient Control Action (Kawela-Kapualei, Moloka`i)	
Description: The waters along the south Moloka`i coast are listed under the CWA 303 (d) as impaired due to regular exceedance of water quality standards for nutrients, turbidity, and suspended solids. This project will identify anthropogenic sources of nutrients and impacts on reef flat ecosystems and appropriate nutrient control mechanisms.	
Status: Unfunded	**Duration:** 2 years
Lead organization: To be determined	**Partner Organizations:** To be determined
Estimated Cost: To be determined	**Potential Funding Sources:** EPA, NRCS
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** This action would provide a better understanding of the relationship between impaired coastal waters listed under CWA Section 303 (d) and coral reef ecosystem health.

Table 3.3 Kawela to Kapualei, Moloka`i— Detailed Description of Ongoing (Funded) Actions

Action 1.1 East Moloka`i Watershed Partnership – Phase I Feral Animal Control Program (Kawela-Kapualei, Moloka`i)	
Description: Feral animals (mainly goats) in the upper watershed areas of south Moloka`i are major contributors to soil erosion and destruction of native vegetation. Feral animal control, through strategic fencing, hunting, trapping, and aerial shooting, is considered an important vital best management practice to reduce sediment load to surface water. In 2001, TNC, together with private land owners under the EMoWP and NRCS, completed 5.5 miles of strategic fencing in the upper watershed. In association with this fence, a feral animal control program is being implemented that includes (1) fence maintenance and improvement, (2) aerial shooting to reduce goat population (2,500 every 2 years), (3) helicopter-assisted hunts to reduce goat population (500 per year), (4) pig hunting and trap baiting program in upper areas, (5) weed control activities, and (6) monitoring (feral animal surveys, vegetation, weather data).	
Status: Funded	**Duration:** 2000 – ongoing
Lead organization: TNC	**Partner Organizations:** EMoWP, Kamehameha Schools, Kapualei Ranch, TNC, DLNR, Maui County, USFWS, MLSWCD
Cost: $1,000,000	**Funding Sources:** TNC, DLNR Natural Area Reserve System Fund, Maui County Board of Water Supply, Maui County Office of Economic Development, USDA Enterprise Community, USFWS Partners Program, NRCS Wildlife Habitat Incentive Program, Maui County Department of Public Works
Significance of Outputs: A functional and effective feral animal control program has been developed and is reducing feral animal population and impacts to native forests.	**Lessons Learned:** Feral animal control requires a multipronged, long-term approach. Public hunting programs with trained hunt leaders has proven effective in controlling feral animals.
Action 2.1 Long-Term Temporal Variability in Sediment Transport Patterns on the Fringing Reef Flat off South-Central Moloka`i (Kawela-Kapualei, Moloka`i)	
Description: The goal was to investigate flow and sediment resuspension on the fringing reef off Moloka`i, Hawai`i. A 2-year-long experiment was completed to understand the processes governing fine-grained sediment suspension and transport on the reef flat. An instrument package was deployed on the reef flat to better understand the nature of fluid flow and sediment suspension over different seasons and years. Observations from this study elucidate the complex interactions between waves, tides, and mean currents that drive fine-grained terrestrial sediment suspension on the reef flat adjacent to a depauperate section of the fore reef.	
Status: Funded	**Duration:** 2 years
Lead organization: USGS	**Partner Organizations:** University of California at Santa Cruz, University of Washington, University of Hawai`i, DAR
Cost: $75,000	**Funding Sources:** USGS
Significance of Outputs: The only known long–time-series process data on a fringing coral reef flat in Hawai`i was compiled and analyzed. Daily resuspension events occur in response to winds and tidal elevation on the reef flat, and the magnitude of the events depends in turn on the interaction between tidal elevation and trade wind velocity. The net flux of sediment on this reef is primarily along the reef flat in the direction of the prevailing trade winds (to the west), with a secondary direction of slightly offshore. The resuspension and turbidity that were observed resulted from fine-grained terrigenous sediment trapped and recycled on the reef flat. Thus, corals are subjected to light blockage by the same particles repeatedly for years, however small the amount.	**Lessons Learned:** This study shows the importance of trade winds and ocean wave heights in controlling the movement of sediment. The measurements showed high temporal variability of sediment resuspension, indicating that single measurements are inadequate to accurately describe conditions on a reef flat.

Table 3.3 Kawela to Kapualei, Moloka`i— Detailed Description of Ongoing (Funded) Actions (Continued)

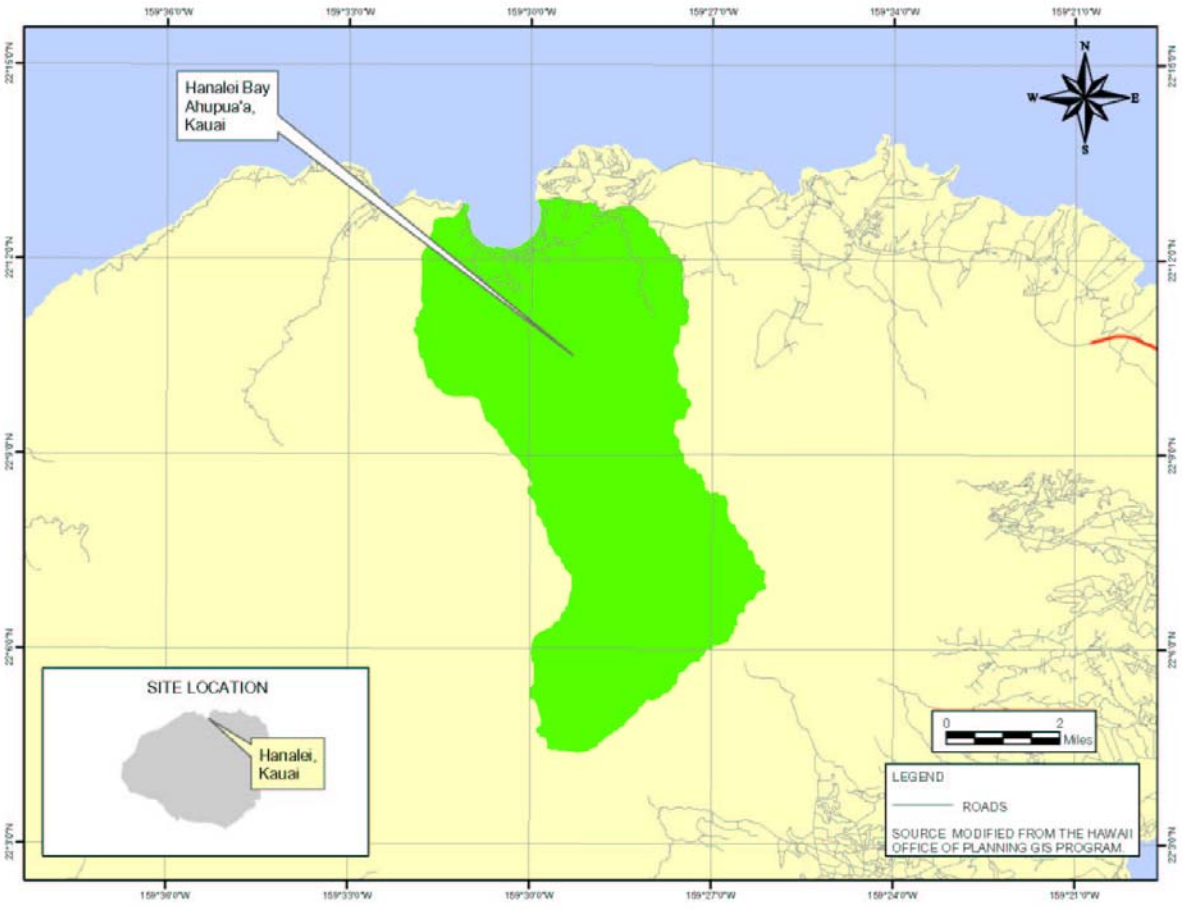
Action 2.2 Across-Reef Water and Suspended Sediment Flux Experiment: South-Central Moloka`i (Kawela-Kapualei, Moloka`i)	
Description: The goal was to investigate across-reef transport processes on the fringing reef off Moloka'i, Hawai'i. An experiment was carried out that had as its main goal to understand the processes governing fine-grained terrestrial sediment suspension on the reef flat and its suspected advection across a fringing coral reef. Instruments were deployed at four stations to better understand the nature of fluid flow and sediment suspension across the reef. These observations elucidate the complex interactions between waves, tides, and mean currents that drive fine-grained terrestrial sediment suspension on the reef flat and its advection out over the reef crest and onto the depauperate section of the fore reef.	
Status: Funded	**Duration:** 4 months
Lead organization: USGS	**Partner Organizations:** University of Washington, University of Hawai`i, DAR
Cost: $35,000	**Funding Sources:** To be determined
Significance of Outputs: Observations on the fore reef show relatively high turbidity throughout the water column during the ebb tide. It therefore appears that high SSC on the deeper fore reef, where active coral growth is at a maximum, are dynamically linked to processes on the muddy, shallow reef flat.	**Lessons Learned:** Relatively cool, clear water flows up onto the reef flat during flooding tides. At high tide, more deep-water wave energy is able to propagate onto the reef flat, and larger trade-wind-driven waves can develop on the reef flat, thereby increasing sediment suspension concentrations (SSC). Trade-wind-driven surface currents and wave breaking at the reef crest cause setup of water on the reef flat, further increasing the water depth and enhancing the development of depth-limited waves and SSC. As the tide ebbs, the water and associated suspended sediment on the reef flat drains off the reef flat and is advected offshore and to the west by trade-wind- and tidally driven currents.
Action 2.3 Spatial Variability in Sediment Transport Patterns on a Fringing Reef: South-Central Moloka`i	
Description: Spatial surveys of sediment transport processes aimed at studying the effect of terrestrial sedimentation on the health of coral reefs were conducted. Spatial data were collected with a portable sediment dynamics "backpack" containing instruments to measure near-bed current velocities, suspended sediment concentration (SSC), wave orbital velocities, temperature, salinity and mean water elevation at point locations on the reef flat from the shoreline out to the reef crest.	
Status: Funded	**Duration:** 4 months
Lead organization: USGS	**Partner Organizations:** University of Washington, University of Hawai`i, DAR
Cost: $30,000	**Funding Sources:** USGS
Significance of Outputs: The only known data set on the two-dimensional spatial variability in processes driving flow and sediment resuspension on a fringing coral reef flat in Hawai`i was compiled and analyzed. These measurements reveal a horizontal near-bed current and suspended sediment concentration (SSC) structure that is primarily controlled by water depth, trade wind conditions, coastline orientation and man-made structures (i.e. an impermeable wharf and native Hawaiian fish ponds).	**Lessons Learned:** The highest SSC were measured on the inner and central reef flat during high tide when there is the potential for increased propagation of offshore wave energy and generation of trade wind waves to resuspend sediment. Most of the suspended sediment transport on the reef flat is in a westward alongshore direction, as a response to prevailing trade winds. The impermeable wharf and fish ponds act as a barrier for sediment transport, halting the alongshore flow, trapping sediment and creating an offshore flux component.

Section 4.0
Action Plan for Hanalei, Kaua`i

4.0 Action Plan for Hanalei, Kaua`i

The Hanalei watershed is located along the north shore of the island of Kaua`i, Hawai`i. It is a 23.7-square-mile area that extends from the top of Mount Wai`ale`ale (5,148 ft) to Hanalei Bay, defined by Pu`u Po`a and Makahoa Points. Within the watershed, the Hanalei River and other streams run through four subwatersheds: the Hanalei, Waipa, Wai`oli and Waikoko ahupua`a.

Figure 4-1. Site Location Map for Hanalei Bay Watershed, Kaua`i



The Hanalei ahupua`a supports an array of valuable land uses and attributes such as residential and resort development, agriculture, recreation, biodiversity, and preservation of a native culture. Hanalei Valley farmers produce over 67 percent of the state's taro, a staple in the traditional Hawaiian diet. It is a multijurisdictional area, comprising the Hanalei National Wildlife Refuge, Halele`a State Forest Reserve, Kaua`i County beach parks and private land holdings.

Both the Hanalei River and the Hanalei Bay are significant recreational and commercial use areas for paddling, kayaking, fishing (for both estuarine fish and endemic freshwater `o`opu),

crabbing, and prawning. Subsistence fishing in the river and bay provides an important and regular source of food for the local population. The river is a favorite site for children to swim, since it is both shallow and protected from the surf. Commercial companies based directly on the river offer kayaking and snorkeling tours of the river. Tour companies embark from Hanalei Bay for trips to the famed Nā Pali coast. Both commercial and recreational fishing boats launch from these sites. Popular county parks and a campground are located at the river mouth and along the Bay. Honored in song and story, it is an area of unique cultural significance to the Hawaiian people. In June 1998, the Hanalei River was designated an American Heritage River.

4.1 Land-Based Pollution Threats

Hanalei River and Bay are listed on Hawai`i's 2002 Clean Water Act 303(d) list of impaired waters. The Waipa and Wai`oli streams are listed as water bodies requiring future monitoring. (DOH 2002)

Impaired Water Bodies in the Hanalei Ahupua`a Listed under Section 303 (d) of the Clean Water Act					
Listed Water Body	**Geographic Scope of Listing**	**Pollutant(s)**	**Basis for Listing**	**Standard**	**Priority**
Hanalei River	Hanalei River	Turbidity	Visual assessment	NA	M
Hanalei River	Hanalei River (Weke Rd.) station	Enterococcus	Numeric assessment	Wet/Dry	H
Hanalei Bay	Hanalei Bay Landing station	Enterococcus	Numeric assessment	Wet/Dry	L

The Hanalei River is approximately 16.2 miles long. Its headwaters receive intermittent but extremely heavy rainfall (450 inches/year). Hanalei River's long-term average discharge is 140 million gallons per day (gpd), with low-flow averages of 20-50 million gpd, and as high as 6 billion gpd (Berg et al 1997). An estimated 7560 (+/-2910) milligrams of sediment per year is removed from the upper Hanalei River valley by the river. This sediment yield translates into a denudation rate of approximately 0.07-0.16 millimeters per year (Calhoun and Fletcher 1999).

Hanalei Bay
(Photograph by Jay Griffin, 2000)

Landuse activities that contribute to the surface water and groundwater pollution in the Hanalei ahupua`a include urbanization, agriculture, recreational uses, and the activities of feral animals in the upper watershed. The entire Hanalei Bay coastal area is within a Wastewater Critical Area. Hanalei town is a densely populated rural village surrounded by wetlands. Single-family homes are now being used as multi-family vacation rentals and are being converted to restaurants and other high-density uses without upgrading wastewater systems. Shallow groundwater is polluted by the associated cesspools and septic systems and flows directly to Hanalei Bay and River, causing public health concerns about the waters. Like many coastal towns, Hanalei lacks centralized wastewater collection and treatment.

Land-based pollution sources in the Hanalei watershed include the following:

- Feral ungulates combined with invasion of alien plants increase soil erosion in the upper watershed, resulting in increased suspended solids, nutrients, and pathogens in surface water runoff

- Nutrient and bacterial contamination of groundwater by cesspools and septic systems in riparian areas along the Hanalei River and in sandy coastal areas along Hanalei Bay leaches into river and coastal waters. Hanalei town has approximately 225 cesspools, 75 septic systems, and 2 package treatment plants with injection wells. Most homes in Hanalei town are situated between the Hanalei River and Wai`oli Stream, just inland from the beach.

- Polluted surface water runoff from agriculture (mainly taro ponds), grazing practices, and waterbird impoundments is transported to Hanalei River. Nutrients, pathogens, and suspended solids are primary pollutants from these activities. Pesticides have been used to control invasive species, but they may degrade river water quality and have unknown impacts on the coral reefs. Bioaccumulation of pesticides is reported to be minimal in biota from the Hanalei River (Orazio et al 2002)

- Sailboats and other vessels moored in or passing near Hanalei Bay discharge oil and grease, solid waste, and human wastes.

4.2 Other Threats

At present, land-based pollution is the only priority threat identified for the coral reef ecosystem in Hanalei Bay.

4.3 Coral Reef Ecosystem Status

Coral recruitment and health of the coral reef ecosystem in Hanalei Bay may be affected by polluted river discharge on the reefs of Pu`u Po`a Point; however, the low average coral cover (15 percent) is largely attributable to strong winter storm conditions that generate large waves. Demersal and pelagic fisheries are largely underexploited.

Fishing pressure is low, and subsistence fishing is used for supplemental food and income. Sea turtles are abundant in Hanalei Bay; they exhibit a low incidence of the bacterial infections that are often characteristic of turtles inhabiting polluted waters.

Humpback whales frequent Hanalei Bay, which serves as a birthing area. Hanalei Bay is included in the Hawaiian Islands Humpback Whale National Marine Sanctuary approved by the U.S. Congress in 1997.

4.4 Proposed and Ongoing Actions

Actions to reduce land-based pollution inputs to the coral reef ecosystem in Hanalei Bay include best management practices, research and monitoring, and outreach activities. Many of the actions are funded under EPA's Hanalei Watershed Initiative Grant through the Hanalei Watershed Hui (HWH), a nongovernmental organization working to improve water quality conditions in Hanalei River and Bay. The duration of the grant is from 2003 to 2005.

Potential new projects identified through stakeholder consultations include a study of sedimentation and sediment transport within Hanalei Bay to document temporal changes in sedimentation. New projects also include documenting any changes in sediment load resulting from the implementation of BMPs.

The following tables present proposed and ongoing actions to address land-based pollution threats to coral reefs in the Hanalei watershed. Table 4.1 summarizes the proposed (unfunded) and ongoing (funded) actions. Table 4.2 provides a description of each proposed action, and Table 4.3 describes the ongoing actions. Appendix A provides the funding status of proposed actions.

Table 4.1 Hanalei, Kaua`i—Summary of Actions to Address Land-Based Pollution Threats on Coral Reefs

Threat/Focus Area: *Land-Based Pollution*
Goal: *Reduce land-based pollution to improve coastal water quality and coral reef ecosystem function and health*
Indicator: *Land-based pollution sources reduced in selected ahupua`a and statewide*

Proposed and Ongoing Actions	Type of Action					Action Status		
	Policy Reform	Best Management Practices	Technical Assistance	Research and Monitoring	Outreach and Education	Unfunded	Funded	Completed
Objective 1: *Reduce pollutant load to surface water and groundwater through site-specific actions and best management practices* **Indicator:** *No. of site-specific pollution prevention and control measures being implemented*								
Proposed Action: Construction of Wastewater Treatment System for Hanalei Town		X				X		
Proposed Action: Implementation of Native Forest Protection for Hanalei Watershed (Hanalei, Kaua`i)		X				X		
Action 1.1 Cesspool Replacement in Lower Hanalei Watershed (Hanalei, Kaua`i)		X					X	
Action 1.2 Public Bathroom Upgrades at Beach Parks (Hanalei, Kaua`i)		X					X	
Action 1.3 Centralized Wastewater Treatment Design Alternatives for Hanalei Town (Hanalei, Kaua`i)		X					X	
Action 1.4 Innovative Best Management Practices for Sediment Control from Taro Farms (Hanalei, Kaua`i)		X					X	
Action 1.5 Livestock Exclusion Fences to Control Stream Bank Erosion Along Waipa Stream (Hanalei, Kaua`i)		X					X	

Table 4.1 Hanalei, Kaua`i—Summary of Actions to Address Land-Based Pollution Threats on Coral Reefs (Continued)

Proposed and Ongoing Actions	Type of Action					Action Status		
	Policy Reform	Best Management Practices	Technical Assistance	Research and Monitoring	Outreach and Education	Unfunded	Funded	Completed
Objective 2: *Improve our understanding of the links between land-based pollution and coral reef health through focused scientific research and monitoring* **Indicator:** *No. of management decisions informed by the results of focused scientific research and monitoring*								
Proposed Action: Analysis of 10-Year Data Set on Coral Cover in Hanalei Bay (**Priority Action 2C**; Hanalei, Kaua`i)				**X**		**X**		
Proposed Action: Sedimentation and Sediment Transport Monitoring in Hanalei Bay (Hanalei, Kaua`i)				**X**		**X**		
Proposed Action: Long-term Monitoring of Water Quality and Coral Reef Ecosystem Health in Hanalei Bay				**X**		**X**		
Action 2.1 Study on Impacts of Biological Resources on Water Quality in the Hanalei Watershed (Hanalei, Kaua`i)				**X**			**X**	
Action 2.2 Study of Sediment Load to Hanalei River (Hanalei, Kaua`i)				**X**			**X**	
Action 2.3 Hydrologic and Sediment Modeling of Hanalei Watershed (Hanalei, Kaua`i)				**X**			**X**	
Action 2.4 Water Quality Monitoring of Hanalei River and Bay (Hanalei, Kaua`i)				**X**			**X**	
Action 2.5 Coral Reef Assessment and Monitoring (Hanalei, Kaua`i)				**X**			**X**	
Objective 3: *Increase pollution prevention and control awareness statewide* **Indicator:** *Widespread dissemination of best practices and lessons learned in addressing land-based pollution impacts on coral reefs*								
Action 3.1 Hanalei Watershed Outreach Activities (Hanalei, Kaua`i)					**X**		**X**	

Notes:

1. Yellow shading indicates actions proposed for priority (Year 1) funding (see Table 1.1).
2. Proposed (unfunded) actions are described in Table 4.2, and ongoing (funded) actions are described in Table 4.3.
3. Priority unfunded actions identified in 2003. Funding status of priority actions as of March 2004 is provided in Appendix A.

Figure 4.2 Locations of Proposed Action and Best Management Practices to Control Land-Based Pollution in Hanalei, Kaua`i

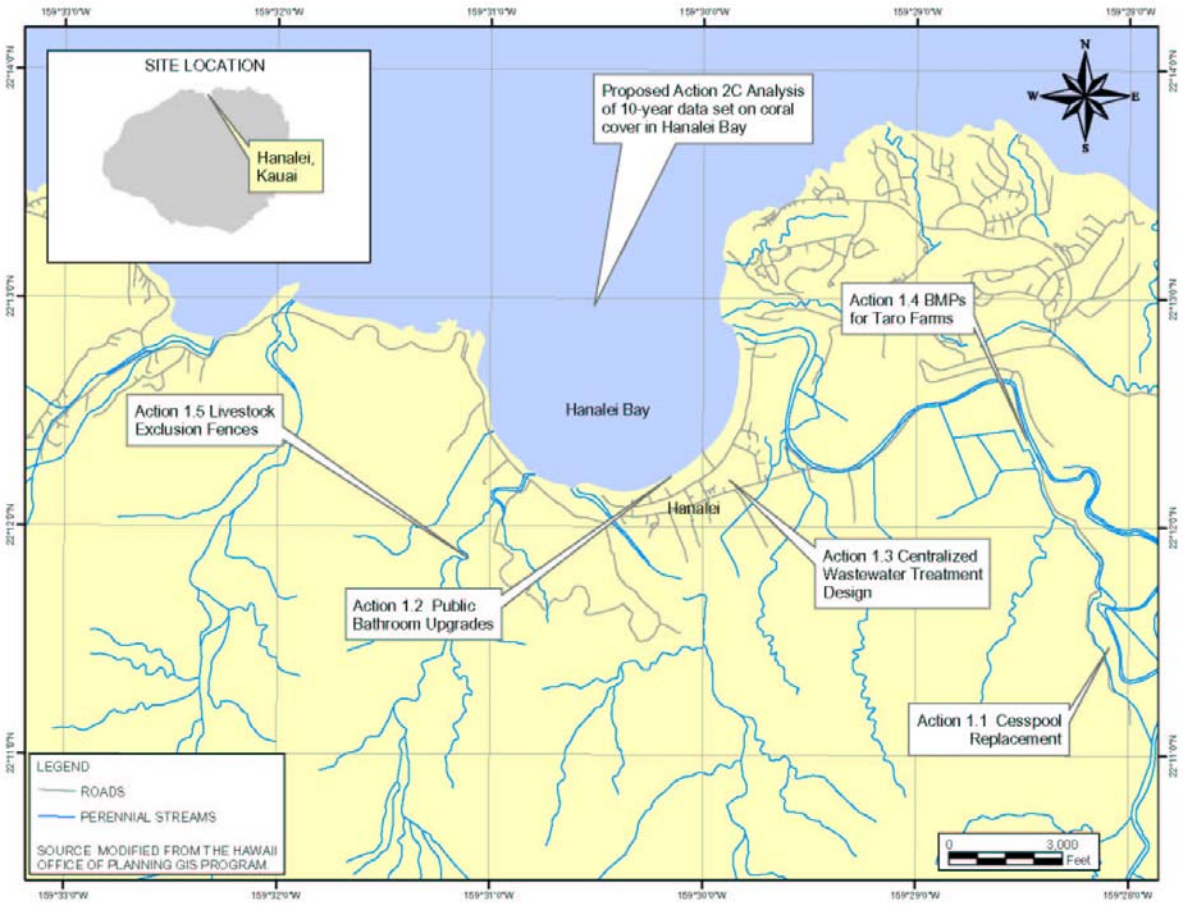


Table 4.2 Hanalei, Kaua`i—Detailed Description of Proposed (Unfunded) Actions

Actions Proposed for Priority Funding	
Proposed Action: Analysis of 10-Year Data Set on Coral Cover in Hanalei Bay (**Priority Action 2C**; Hanalei, Kaua`i)	
Description: Between 1992 and 1994, photoquadrats were used to quantify benthic cover on 22 permanent transects (25 x 5 meters) in a wide variety of habitats in Hanalei Bay, Kaua`i. Twenty of these transects were resurveyed in 1999 using digital video. There is currently a need to analyze these videos to examine trends in benthic cover over the 5-year study period. In addition, this action would assess the same 20 transects in 2004 using digital still photos and conduct quantitative analysis in order to examine trends over a 10-year time period.	
Status: Unfunded	**Duration:** 6 months
Lead Organization: NOAA/NOS	**Partner Organizations:** University of Hawai`i
Estimated Cost: $25,000	**Potential Funding Sources:** USGS
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** Long-term data sets are essential for improving our understanding of the links between land-based pollution and coral reefs and for evaluating the effectiveness of efforts to manage land-use activities.
Other Proposed Actions	
Proposed Action: Construction of Wastewater Treatment System for Hanalei Town	
Description: Wastewater treatment system alternatives for Hanalei town are being investigated under the EPA Watershed Initiative Grant. The actual design and construction of the appropriate system will be implemented by the County of Kaua`i together with other partners and funding agencies.	
Status: Unfunded	**Duration:** To be determined
Lead Organization: County of Kaua`i	**Partner Organizations:** To be determined
Estimated Cost: To be determined based on system	**Potential Funding Sources:** To be determined
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** An appropriate wastewater treatment system for the town of Hanalei will replace existing cesspools and reduce pollutant loads to groundwater and surface water.
Proposed Action: Implementation of Native Forest Protection for Hanalei Watershed (Hanalei, Kaua`i)	
Description: Biophysical assessments currently being conducted by USGS and NRCS will identify soil erosion control best management practices for the upper Hanalei watershed. This proposed action would provide resources for the implementation of soil erosion control and native forest protection measures.	
Status: Unfunded	**Duration:** 3 years
Lead Organization: To be determined	**Partner Organizations:** USGS, EPA, NRCS
Estimated Cost: $500,000	**Potential Funding Sources:** EPA, NRCS
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** Native forest protection measures are expected to reduce soil erosion. These measures will have applicability to other similar watersheds in Hawai`i.

Table 4.2 Hanalei, Kaua`i—Detailed Description of Proposed (Unfunded) Actions (Continued)

Other Proposed Actions (Continued)	
Proposed Action: Sedimentation and Sediment Transport Monitoring in Hanalei Bay (Hanalei, Kaua`i)	
Description: An understanding of sedimentation and sediment transport within Hanalei Bay was identified as a significant gap in linking coral reef health with best management practices to reduce land-based suspended solid loads. Monitoring sedimentation and sediment transport patterns within the bay is proposed to complement ongoing monitoring programs focused on assessments of coral cover and recruitment and assessing reef exposure to turbidity and sediment deposition and resuspension.	
Status: Unfunded	**Duration:** 3 years
Lead Organization: To be determined	**Partner Organizations:** USGS, EPA
Estimated Cost: $300,000	**Potential Funding Sources:** USGS
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** An understanding of the dynamics of sedimentation and sediment transport in the bay will provide an important link between efforts to reduce land-based pollution and coral reef health.
Proposed Action: Long-Term Monitoring of Water Quality and Coral Reef Ecosystem Health in Hanalei Bay	
Description: Monitoring of water quality and coral reef ecosystem parameters will be conducted under the EPA Watershed Initiative for 3 years. That monitoring effort will provide an excellent baseline for funded actions to reduce land-based sources of pollutants; however, a long-term monitoring program for Hanalei Bay is needed to assess the impacts of land management initiatives. This proposed action is to extend the monitoring program for an additional 4 years.	
Status: Unfunded	**Duration:** 2006 to 2010
Lead Organization: University of Hawai`i	**Partner Organizations:** NOAA, EPA
Estimated Cost: $75,000	**Potential Funding Sources:** NOAA, EPA
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** Long-term data sets are required to inform management decisions.

Table 4.3 Hanalei, Kaua`i—Detailed Description of Ongoing (Funded) Actions

Action 1.1 Cesspool Replacement in Lower Hanalei Watershed (Hanalei, Kaua`i)	
Description: Bacterial and nutrient contamination of the rivers and groundwater within the lower Hanalei watershed will be addressed by replacing antiquated cesspools for single-family homes in the Wastewater Critical Area and riparian zones of Hanalei River and Waipa Stream. Innovative on-site treatment systems, using the best available technology and advanced wastewater standards will be constructed at these high-risk, outlying sites along the rivers. Community meetings will be held and consultations will be sought from county, State, and federal wastewater specialists before selection is made. HWH will work closely with the Waipa Foundation for work along Waipa stream and with the USFWS for work within the Hanalei National Wildlife Refuge. Requests for bids will be sought from engineering and construction firms as required. State and County permits will be obtained as required. Construction will begin and be completed as soon as possible in 2004.	
Project Status: Funded	**Duration:** 2003 – 2005
Lead organization: HWH	**Partner Organizations:** Waipa Foundation, USFWS, State and County
Cost: $120,000	**Funding Sources:** EPA Watershed Initiative Grant
Staff, Training & Technical Expertise Needs: Wastewater specialists, Innovative Technology Specialist	
Significance of Outputs: Leaching from cesspools located near streams and coastal areas are a known source of nutrients and bacterial contamination to surface water	**Lessons Learned:** To be determined
Action 1.2 Public Bathroom Upgrade at Beach Parks (Hanalei, Kaua`i)	
Description: The County of Kaua`i will replace the large-capacity cesspool at Hanalei Pavilion Beach Park with two new septic tanks and a new leach field. Improved BMPs for maintenance of septic systems at all three Hanalei beach parks will be developed. Portable toilets will be brought in to augment the facilities during large community events (e.g. surfing contests, outrigger canoe races, Tahiti Fete). Construction will take place during the spring and summer of 2004. Estimated total in-kind, nonfederal contribution from the County of Kaua`i is $50,000.	
Project Status: Funded	**Duration:** 2003 – 2005
Lead organization: County of Kaua`i	**Partner Organizations:** HWH
Cost: $50,000	**Funding Sources:** County of Kaua`i
Staff, Training & Technical Expertise Needs: Wastewater specialists, nonpoint source pollution control specialists	
Significance of Outputs: Leaching from cesspools located near coastal areas are a known source of nutrients and bacterial contamination to surface water	**Lessons Learned:** To be determined
Action 1.3 Centralized Wastewater Treatment Design Alternatives for Hanalei Town (Hanalei, Kaua`i)	
Description: Ongoing community strategic planning for a centralized wastewater collection and treatment system in Hanalei Town is being conducted to determine scale, design criteria, location, discharge options, costs, and funding options. A centralized wastewater treatment system is recommended to minimize groundwater contamination by pathogenic bacteria and nutrients in the lower watershed. The planning and community meetings will continue through the first year of the Watershed Initiative Grant and will be completed with the presentation of a community-endorsed plan being presented to the County of Kaua`i.	
Project Status: Funded	**Duration:** 2003 – 2005
Lead organization: HWH	**Partner Organizations:** County of Kaua`i, community
Cost: $70,512	**Funding Sources:** EPA Watershed Initiative Grant
Staff, Training & Technical Expertise Needs: Community Facilitation, Wastewater Specialist	
Significance of Outputs: This action will help expedite the design of a centralized wastewater system by providing viable alternatives for consideration by the County of Kaua`i	**Lessons Learned:** To be determined

Table 4.3 Hanalei, Kaua`i—Detailed Description of Ongoing (Funded) Actions (Continued)

Action 1.4 Innovative Best Management Practices for Sediment Control from Taro Farms (Hanalei, Kaua`i)	
Description: Innovative BMPs for sediment control from traditional taro agricultural outflows and impoundments will be designed and implemented in cooperation with the Hanalei taro farmers, USFWS and the U.S. Bureau of Reclamation. BMPs for cultivation and harvesting taro, slowing flow rates in outflow drains by increasing depth and width, installing baffles, sediment screens, and livestock fencing will be implemented along with a regular maintenance schedule. These BMPs will be designed primarily to reduce sediment load, but could also reduce nutrient load by uptake of riparian or aquatic vegetation and decrease the density of pathogenic bacteria by increased exposure to lethal solar UV radiation. This initiative will provide $13,000 for materials and fuel, while USFWS will provide $22,500 of in-kind services of expert consultants, heavy machinery, and machinery operators for the work in Hanalei. Waipa Foundation will provide $44,934 in-kind in heavy machinery, machinery operators, and revegetation and monitoring in Waipa Stream. The first 3 months of the project will consist of planning meetings with taro farmers, USFWS personnel, and Bureau of Reclamation consultants brought in by USFWS, Waipa Foundation, and the Hanalei community. Best management practices will be developed in the first year and go into effect throughout the second year. The second year will be devoted to retention drain maintenance and evaluation. Modifications will be made as necessary. Community project-review meetings and final report writing will comprise the final 4 months of the project. Monitoring of turbidity in water coming from the selected drains will be conducted weekly throughout the first 2 years of the project.	
Project Status: Funded	**Duration:** 2003 to 2005
Lead organization: FWS	**Partner Organizations:** FWS, BR, Taro Farmers
Cost: $13,000 (grant); $45,000 (in-kind)	**Funding Sources:** EPA Watershed Initiative
Significance of Outputs:	**Lessons Learned:** To be determined
Action 1.5 Livestock Exclusion Fences to Control Stream Bank Erosion Along Waipa Stream (Hanalei, Kaua`i)	
Description: Livestock exclusion fencing will be installed and maintained in riparian areas of the Waipa Stream to control stream bank erosion in accordance with guidance established by NRCS's Conservation Standard Practice, Fence Code 382. A total of 20,000 linear feet of five-strand barbed wire will be installed on T-posts and treated pine post corners by the Waipa Foundation and HWH staff beginning in January 2004. Areas to be fenced will be determined in conjunction with NRCS as part of its independent program with the Waipa Foundation. A short pre-fencing monitoring period in 2003 is required.	
Project Status: Funded	**Project Duration:** 2003 to 2005
Lead organization: HWH	**Partner Organizations:** NRCS, Waipa Foundation
Cost: $31,200 (grant) $26,000 (in-kind)	**Funding Sources:** EPA Watershed Initiative; Waipa Foundation
Significance of Outputs: Stream bank erosion will be controlled by excluding livestock	**Lessons Learned:** To be determined

Table 4.3 Hanalei, Kaua`i—Detailed Description of Ongoing (Funded) Actions (Continued)

Action 2.1 Study on Impacts of Biological Resources on Water Quality in the Hanalei Watershed (Hanalei, Kaua`i)	
Description: A study of the biological resources of the aquatic, riparian, and estuarine systems in the Hanalei Watershed will be conducted to determine their impact on water quality issues. Treatments for the enhancement of these ecosystems will be modeled. This action consists of eight specific steps: (1) Determine distribution, abundance and quality (e.g. reproductive condition and status, health) of native listed endangered plant species. (2) Do the same for invasive plant species. (3) Determine distribution, abundance and quality (e.g. reproductive condition and status, health) of feral cats, pigs, aquatic organisms (e.g. apple snail, upstream fish), and rodents. (5) Develop geographic information system (GIS) map overlays and Global Positioning System locations of specific plant populations and animal home ranges. (6) Using water quality data obtained from in-stream gauges determine impacts of faunal and floral distributions and ecosystem quality on water quality parameters, and develop models demonstrating how management of alien plants and animals might improve water quality. (7) Establish a community-accessible database that can be updated with future monitoring studies and located at the Hawai`i Ecosystems At-Risk (HEAR) project (see summary at www.hear.org) and stored on the Pacific Basin Information Node (PBIN) server of USGS. (8) Determine best management practices for invasive species in the watershed. Practical Objectives: (1) Upgrade the current in-stream water gauge to collect sediment information related to water quality. (2) Determine relative plant and animal densities in the upper watershed to establish GIS maps that will enhance management opportunities that may be undertaken in the future by resource agencies or the Hanalei Community Hui. (3) Establish information products, models, and databases for long-term management of the upper and lower watershed, its biota, and water quality. The USGS and NRCS will develop BMPs for soil erosion control in the upper watershed based on the results of this study.	
Project Status: Funded	**Project Duration:** 2003 – 2005
Lead organization: USGS	**Partner Organizations:** NRCS, HWH
Cost: $85,000	**Funding Sources:** EPA Watershed Initiative
Significance of Outputs: This action will provide valuable biophysical data as a basis for developing and implementing best management practices to control soil erosion and invasive plants	**Lessons Learned:** To be determined
Action 2.2 Study of Sediment Load to Hanalei River (Hanalei, Kaua`i)	
Description: The Hanalei River of Kaua`i is one of only 14 American Heritage Rivers in the nation, and is used for farming, recreation, tourism, and wildlife habitat. Although the river has outstanding scenic and cultural resources, the river and the bay at the river's mouth are listed on the State of Hawai`i's Section 303 (d) list of impaired waters owing to high concentrations of sediment and bacteria. Sediment is believed to adversely affect both in-stream aquatic habitat and offshore coral reefs. Some sediment is carried by the river as a result of natural erosional processes; however, erosion and sedimentation are often accelerated by land uses such as farming, and by introduced plant and animal species in steep forested watersheds. In order to develop effective BMPs for land-use activities within the watershed, information on the amount and timing of the sediment loads carried by the river is needed. The USGS will determine daily suspended sediment loads at its existing Hanalei River stream gauging station (16103000) from October 1, 2003, to September 30, 2005.	
Project Status: Funded	**Project Duration:** 2003 – 2005
Lead organization: USGS	**Partner Organizations:** Hanalei River Hui
Cost: $60,000	**Funding Sources:** EPA Watershed Initiative
Significance of Outputs: This study will provide valuable information on suspended sediments loads as a basis for developing effective measures to reduce these loads to Hanalei River	**Lessons Learned:** To be determined

Table 4.3 Hanalei, Kaua`i—Detailed Description of Ongoing (Funded) Actions (Continued)

Action 2.3 Hydrologic and Sediment Modeling of Hanalei Watershed (Hanalei, Kaua`i)	
Description: NRCS will conduct hydrologic and sediment modeling in the Hanalei watershed. Final products include computer models, water budget, sediment budget, and BMPs. Technical assistance is committed from the NRCS National Water Management Center. This modeling effort will incorporate results from studies by USGS on sediment load and biological resources.	
Lead organization: NRCS	**Partner Organizations:** USGS
Project Status: Funded	**Project Duration:** 2003 – 2004
Cost: $75,000	**Funding Sources:** NRCS
Significance of Outputs: The results of the modeling effort are expected to provide a holistic view of physical processes in the watershed	**Lessons Learned:** To be determined
Action 2.4 Water Quality Monitoring of Hanalei River and Bay (Hanalei, Kaua`i)	
Description: Water quality monitoring will be conducted along the Hanalei River. Water samples will be analyzed for salinity, pH, temperature, turbidity, total suspended solids, nutrients (total nitrogen, nitrate and nitrite, and phosphate) and enterococci bacteria on a monthly basis (including both three low-flow and three extreme-high-flow events). The lower reach of the three streams entering Hanalei Bay (Wai`oli, Waipa and Waikoko) will also be sampled. Flow rate will be measured using a portable flow meter, and the volume of discharge during sampling for each of the three streams will be computed. The USGS gauge data and USGS calculations will be used to determine discharge from Hanalei River. Turbidity measurements will be made on a weekly basis on samples from selected drains from taro fields and USFWS impoundments, from the lower reaches of all three streams, and from five sites along the Hanalei River. Enteroccoci and salinity measurements will be made on a weekly basis on samples from the lower reaches of all three streams, the Hanalei River, and from waters fronting the three County beach parks on Hanalei Bay.	
Project Status: Funded	**Project Duration:** 2003 – 2005
Lead organization: Hanalei Watershed Hui	**Partner Organizations:**
Cost: $176,622	**Funding Sources:** EPA Watershed Initiative
Significance of Outputs: Water quality monitoring is essential to determine impacts of best management practices	**Lessons Learned:** To be determined
Action 2.5 Coral Reef Assessment and Monitoring (Hanalei, Kaua`i)	
Description: The Hawai`i Coral Reef Assessment and Monitoring Program (CRAMP) has been monitoring Hanalei Bay and 30 other sites throughout the State of Hawai`i since 1998. The coral reefs of Pu`u Po's and Makahoa Points delineate the mouth of Hanalei Bay. Five sites will be selected along a gradient from the reef area directly falling under the influence of river pollutants to a control site outside of the rivers influence. Detailed assessments of benthic communities (coral and algae) and fish populations will be conducted in the bay. Coral recruitment is an important and most sensitive indicator of coral reef health and recovery. Rate of coral settlement is very sensitive to sedimentation, nutrients and environmental contaminants including pesticides. Coral recruitment, a sensitive indicator of coral reef health and recovery, will be studied using settling plates and natural surfaces of the reef.	
Project Status: Funded	**Project Duration:** 2003 – 2005
Lead organization: University of Hawai`i, HIMB	**Partner Organizations:** NOAA NOS
Cost: $39,000 (grant); $5,600 (in-kind)	**Funding Sources:** EPA Watershed Initiative
Significance of Outputs: Regular monitoring of coral reef health is vital to evaluate long term trends	**Lessons Learned:** To be determined

Table 4.3 Hanalei, Kaua`i—Detailed Description of Ongoing (Funded) Actions (Continued)

Action 3.1 Hanalei Watershed Outreach Activities (Hanalei, Kaua`i)	
Description: As part of the Hanalei Watershed Initiative, outreach activities will be conducted to foster ongoing community participation and to disseminate accomplishments and lessons learned to other islands in Hawai`i as well as other locales with similar environmental conditions via the web sites for American Heritage Rivers Initiative, Coastal America, EPA Watershed Initiative, USGS, NRCS, University of Hawai'i and related links. Hawai'i and Region IX partners such as Guam, Commonwealth of the Northern Marianas Islands, and American Samoa, and locations with similar issues such as Florida, Puerto Rico, and the U.S. Virgin Islands, will be targeted via the EPA Watershed web site. Project staff will present reports at state, conferences and at the EPA Watershed Initiative annual conferences. The Hanalei community will be invited to participate in community meetings about this watershed initiative, and volunteer participation will be encouraged. Quarterly newsletters will be produced for distribution throughout the community providing project updates and opportunities for involvement. Community forums on specific projects will be convened, video recorded and broadcast on local public access television with tapes available for borrowing at the Kaua'i public libraries and the HWH office. Communication and coordination with partnering government agencies will occur in regular email correspondence and meetings will be convened with all agencies involved invited. HWH will continue to maintain a website (www.hanaleiriver.org) in which general information updates and water quality data are posted monthly. Waipa Foundation will play a major role in community outreach and school education through their existing programs.	
Project Status: Funded	**Project Duration:** 2003 – 2005
Lead organization: Hanalei Watershed Hui	**Partner Organizations:** Waipa Foundation
Cost: $47,456 (grant); $31,800 (in-kind)	**Funding Sources:** EPA Watershed Initiative
Significance of Outputs: Experiences gained in the Hanalei watershed are documented and disseminated for use by other watershed initiatives.	**Lessons Learned:** To be determined

Section 5.0
Action Plan for Statewide Research, Monitoring, and Community Awareness

5.0 Action Plan for Statewide Research, Monitoring, and Community Awareness

Actions for statewide implementation were identified to meet objectives 2 (focused scientific research and monitoring) and 3 (increased awareness of pollution prevention and control measures). Proposed and ongoing actions for scientific research and monitoring are presented in Section 5.1, and for pollution prevention and control measures are presented in Section 5.2.

5.1 Action Plan for Research and Monitoring Statewide

Focused scientific research and monitoring are essential to improving our understanding of the links between land-based pollution and coral reef ecosystem health. This action plan describes proposed (unfunded) actions (Table 5.1) and ongoing (funded) actions (Table 5.2) for focused scientific research and monitoring statewide. The results of these studies are expected to inform management decisions to address land-based pollution threats to coral reef ecosystems.

A regional workshop is proposed to develop indicators and protocols to assess coral reef ecosystem health and threats from land-based pollution. These indicators and protocols will be used to establish a long-term monitoring program in the three priority ahupua`a. Appendix A provides the funding status of proposed actions.

Table 5.1 Research and Monitoring Statewide– Detailed Description of Proposed (Unfunded) Actions

Proposed Action: Regional Workshop to Develop Indicators and Protocols to Assess Coral Reef Health and Threats from Land-Based Pollution (**Priority Action 2D**; Statewide and Pacific Region)	
Description: Coral reef scientists use a variety of methods and indicators to assess land based pollution and impacts on the health of coral reef ecosystems. A regional workshop (Pacific Region) will be conducted to provide a venue to inventory the various methods and indicators used in coral reef assessment and to develop a logical framework to apply appropriate methodologies to address specific land based pollution threats to coral reefs and their impacts. Participants of the workshop would include marine scientists, coral reef managers, and representatives from relevant federal and state government agencies and nongovernmental organizations from the U.S. and internationally. Small working groups will be formed to develop different parts of the protocol. The output from the workshop will be a draft protocol that will be distributed for review and comment. A final protocol, incorporating comments, will be published and disseminated for use in long term monitoring of the three priority ahupua`a included in Hawai`i's local action strategy.	
Status: Unfunded	**Duration:** 3 months
Lead Organization: To be determined	**Partner Organizations:** EPA, NOAA, USGS, HCRI, DLNR
Estimated Cost: $25,000	**Potential Funding Sources:** EPA, NOAA, HCRI, USGS
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** The protocol will provide a framework for applying appropriate and relevant methodology and indicators to assessing coral reef health and threats from land-based pollution
Proposed Action: Long-Term Monitoring of Three Priority Ahupua`a Using Pollution Impact Sensitive Indicators (**Priority Action 2E**; Honolua, Maui; Kawela-Kapualei, Moloka`i; Hanalei, Kaua`i)	
Description: Using the indicators and protocols developed in the Regional Workshop, long term monitoring studies will be conducted initially for three years to assess changes in coral ecosystem health as land management activities are implemented in the three priority ahupua`a. A review of all existing monitoring data, parameters sampled and sampling stations will be conducted to develop the study design and identify potential data gaps. Collaboration with ongoing monitoring efforts will be highlighted to avoid duplication of efforts as well as add value to these efforts. Annual workshops will be conducted to review the status of monitoring efforts, assess the indicators and protocols being used and identify areas for improving the indicators and monitoring protocols.	
Status: Unfunded	**Duration:** 3 years (initially)
Lead Organization: To be determined	**Partner Organizations:** University of Hawai`i, TNC, DLNR, USGS
Estimated Cost: $500,000	**Potential Funding Sources:** NOAA, HCRI, USGS
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** A focused, long term monitoring program using relevant indicators and standard protocols is needed to assess the effectiveness of land management on coral reef ecosystem health and to enable comparison between different ahupua`a.
Proposed Action: Assessment of Coral and Fish Disease in Three Priority Ahupua`a in Relationship to Human Wastewater Loads (**Priority Action 2F**; Honolua, Maui; Kawela-Kapualei, Moloka`i; Hanalei, Kaua`i)	
Description: The incidence of coral and fish disease will be assessed in the three priority ahupua`a. The source of human wastewater loads in the Hanalei, Kaua`i ahupua`a are reported from cesspools. Human wastewater loads from Honolua, Maui and Kawela-Kapualei, Moloka`i are expected to be minimal. Human wastewater loads to the marine environment will be estimated from existing information on population density and types of wastewater treatment systems in each ahupua`a. Incidence of fish and coral disease will be assessed in association with quantitative monitoring events.	
Status: Unfunded	**Duration:** 1 year
Lead Organization: Hawai`i State Department of Land and Natural Resources	**Partner Organizations:** EPA
Estimated Cost: $10,000	**Potential Funding Sources:** DLNR
Staff, Training & Technical Expertise Needs: To be determined	**Significance of Expected Outputs:** Coral and fish diseases are often overlooked. This assessment will establish the incidence of these diseases in the three priority ahupua`a.

Table 5.2 Research and Monitoring Statewide– Detailed Description of Ongoing (Funded) Actions

Action 2.1 Assessment of Impact of Human Activities in Marine Protected Areas (O`ahu, Lana`i, Maui, and Hawai`i)	
Description: Several marine protected areas have been established in the main Hawaiian Islands intended primarily to enhance the quality of recreational activities, including snorkeling, SCUBA diving, kayaking, and in some cases, certain types of fishing. Despite the success of these marine protected areas, virtually no quantification of the types, amount, or impacts of human recreational use on coral reef ecosystem health has been conducted. Study sites include: Pupukea, O`ahu; Kealakekua, Hawai`i; Honolua, Maui; and Manele-Hulopo`e, Lana`i. Preliminary results suggest that a few dominant activities, such as snorkeling, are concentrated in relative small patches within each MPA. Occasional high concentrations of human activities in both time and space may result in "impact hotspots." These studies will provide valuable input in assessing the overall carrying capacity of areas used for marine recreation including land based activities as well as marine use.	
Status: Funded	**Project Duration:** 2001 – 2003
Lead organization: University of Hawai`i (K. Holland)	**Partner Organizations:** DLNR
Cost: $100,000	**Funding Sources:** DLNR
Significance of Outputs: The results of the assessment will provide recommendations for improved management of human activities on land as well as marine protected areas.	**Lessons Learned:** Recreational activities may result in localized hotspots that need specific management regimes.
Action 2.2 Cost-Benefit Analysis of Different Management and Financing Regimes of Marine Managed Areas (O`ahu, Maui, and Hawai`i)	
Description: To fill the knowledge gap on the economics of marine managed areas, this project aims to evaluate the costs and benefits of different management and financing regimes for marine managed areas in Hawai`i. Study sites include: Hanauma Bay and Waikiki Diamond Head, O`ahu; Molokini and Honolua Bay, Maui; and Kahalu`u and Wai`opae, Hawai`i. The results of the study can be used to evaluate the costs and benefits of ecosystem management and will provide a basis for investing in improved infrastructure to reduce land based pollutant loads from recreational use.	
Status: Funded	**Project Duration:** 2003
Lead organization: Cesar Environmental Economics Consulting	**Partner Organizations:**
Cost: $65,000	**Funding Sources:** HCRI, DAR, DBEDT
Significance of Outputs: Cost-benefit analysis of is an important tool for evaluating different management and financing regimes.	**Lessons Learned:**
Action 2.3 Assessment, Mapping and Monitoring of Selected "Most Impaired" Coral Reef Areas in the State of Hawai`i (Kane`ohe Bay, O`ahu; South O`ahu; West Maui; and South Moloka`i)	
Description: The project will focus on four major coastal areas identified as the "Most Impaired" for the State of Hawai`i in relation to monitoring and assessment sites throughout the state. Project activities include developing the following: a summary of existing information at each selected site, habitat maps and habitat assessments of each site, quantitative descriptions of benthos and reef fish associated with habitats within each area; and an analysis of causes of reef decline and possible responses of reefs to removal of anthropogenic stresses.	
Status: Funded	**Project Duration:** 2003 - 2004
Lead organization: University of Hawai`i	**Partner Organizations:** DOH
Cost: $86,354	**Funding Sources:** EPA
Significance of Outputs: This study will provide an important assessment of the impacts of water bodies listed as impaired under CWA Section 303 (d) on coral reefs.	**Lessons Learned:** To be determined

Table 5.2 Research and Monitoring Statewide– Detailed Description of Ongoing (Funded) Actions (Continued)

Action 2.4 Assessment of Anthropogenic Impacts on Two Coral Reef Sites on the Big Island of Hawai`i (Kealakekua Bay and Honokohau Small Boat Harbor)	
Description: The purpose of this project is to develop and test protocols to assess anthropogenic impacts on coral reef health in coastal waters of Hawai`i. Project objectives include: (1) map the distribution of anthropogenic nitrogen in two reef environments; (2) establish new "baseline" data to compare with previous studies (20+ year old) and future, post-development studies; (3) compare and contrast benthic and seston biomass to assess how nutrient loading affects each component; (4) develop a two-box mixing model to simulate nitrogen inputs due to groundwater discharge.	
Status: Funded	**Project Duration:** 2003
Lead organization: University of Hawai`i, Hilo	**Partner Organizations:** DLNR
Cost: $142,767	**Funding Sources:** EPA, HCRI
Significance of Outputs: The major outcome of this project will be to have established baseline data on anthropogenic nitrogen to evaluate impacts from future coastal development on coral reefs.	**Lessons Learned:** To be determined

5.2 Action Plan for Pollution Prevention and Control Awareness Statewide

Increased awareness of the threats posed by land-based pollution to coral reef health, and measures to address these threats are vital to achieving the overall goal of Hawai`i's local action strategy. This action plan describes proposed (unfunded) actions (Table 5.3) for increasing pollution prevention and control awareness statewide. Achievements and lessons learned in implementing local actions in the three priority ahupua`a will be documented for widespread dissemination to serve as a catalyst for pollution controls being developed and implemented in other areas of the State. Appendix A provides the funding status of proposed actions.

The three priority ahupua`a will be used as learning models for addressing land-based pollution threats to coral reefs. Through workshops and coordination mechanisms, these achievements and lessons learned will be documented and shared with a broad stakeholder base in the State and Pacific region.

Table 5.3 Pollution Prevention and Control Awareness Statewide– Detailed Description of Proposed (Unfunded) Actions

<table>
<tr><td colspan="2">Proposed Action: Local Action Strategy Coordination, Implementation, and Monitoring (Priority Action 3A, Statewide)</td></tr>
<tr><td colspan="2">Description: Coordination and technical assistance is required to realize the full implementation of the strategy. Hawai`i's local action strategy to address land based pollution threats to coral reefs identifies specific actions that are funded and ongoing as well as new actions that require further development and funding. In addition, the strategy highlights the need to address cross cutting issues and other threats to coral reefs, such as overuse and recreational fishing, in specific geographic areas. A coordinator is proposed to assist in the following activities: (1) assist implementation groups identify relevant funding sources, develop proposals for funding, and facilitate the submission and review of proposals to different funding agencies; (2) provide technical assistance on project implementation to stakeholder groups in the priority ahupua`a and other areas; (3) facilitate information and data sharing among priority ahupua`a and expand the constituency of stakeholders engaged in addressing land based pollution threats to coral reefs; (4) organize workshop series on land based pollution threats to coral reefs; (5) analyze data and information and monitor progress of action plans in priority ahupua`a; (5) update databases, prepare progress reports, and facilitate annual review and revision of the local action strategy.</td></tr>
<tr><td>Status: Unfunded</td><td>Duration: 3 years</td></tr>
<tr><td>Lead Organization: To be determined</td><td>Partner Organizations: DLNR, EPA, NRCS, NOAA</td></tr>
<tr><td>Estimated Cost: $200,000 (3 years)</td><td>Potential Funding Sources: NOAA, EPA, DLNR</td></tr>
<tr><td>Staff, Training & Technical Expertise Needs: Coordinator able to work with broad range of stakeholders and government agencies, technical background with capacity to analyze data and information and monitor land based pollution prevention and coral reef ecosystem projects; proposal development, monitoring, reporting, and communication skills.</td><td>Significance of Expected Outputs: Focused technical and funding assistance to front line implementers will provide the foundation for achieving the goals and objectives identified in the local action strategy.</td></tr>
<tr><td colspan="2">Proposed Action: Workshop Series on Land-Based Pollution Threats to Coral Reefs (Priority Action 3B; Statewide and Pacific Region)</td></tr>
<tr><td colspan="2">Description: Workshops and meetings will be conducted to review progress in each of the three priority ahupua'a as well as other projects and programs addressing land based pollution threats to coral reefs. Workshops will be held in Moloka`i, Maui, and Kaua`i, with field trips to view best management practices being implemented to control land based pollution and the status of the coral reef ecosystem guided by field implementers. Technical workshops on stormwater management, monitoring, and other priority subjects, will be held to improve our understanding of the links between land management and coral reef health. Participants will include representatives from federal, state, and local government, nongovernmental organizations, and academic institutions. In particular, representatives from other watershed-based initiatives in the State (and Pacific Region) will be invited to share experiences. Accomplishments and lessons learned in planning and implementing actions to address land based pollution threats to coral reefs will be documented in a popularized format for widespread dissemination throughout the State and Pacific Region. The outputs from this workshop series will feed into Hawai`i's local action strategy for outreach and education to address low public awareness. Outcomes will help set statewide priorities for the State's Polluted Runoff Control Program.</td></tr>
<tr><td>Status: Unfunded</td><td>Duration: 3 years</td></tr>
<tr><td>Lead Organization: To be determined</td><td>Partner Organizations: EPA, NRCS, DLNR, DOH</td></tr>
<tr><td>Estimated Cost: $50,000</td><td>Potential Funding Sources: EPA, NOAA, DLNR</td></tr>
<tr><td>Staff, Training & Technical Expertise Needs: Facilitation, documentation, popularizing lessons learned for dissemination</td><td>Significance of Expected Outputs: Workshop series will provide a venue to document and disseminate field experiences and lessons learned</td></tr>
</table>

Table 5.3 Pollution Prevention and Control Awareness Statewide– Detailed Description of Proposed (Unfunded) Actions (Continued)

Proposed Action: Collaboration and Linkage on Public Education and Outreach Between Hawai`i's Local Action Strategy to Address Land-Based Pollution Threats to Coral Reefs and Hawai`i's Living Reef Program (Statewide and Pacific Region)	
Description: This action will provide mechanisms to integrate lessons learned, public awareness messages, and other outputs resulting from the implementation of actions in the three priority ahupua'a (Honolua Maui; Kawela to Kapualei, Moloka`i; and Hanalei, Kaua`i) described in Hawai`i's local action strategy into Hawai`i's Living Reef Program. Hawai`i's Living Reef Program is a comprehensive education campaign to increase public awareness and action to protect Hawai`i's coral reefs from various threats including land-based pollution. This action will facilitate (1) documentation of lessons learned, identification of information and messages for public dissemination, and reporting of regular updates to Hawai`i's Living Reef Program, (2) collaboration on land-based pollution messages as part of Hawai`i's Living Reef Program outreach campaign, and (3) assistance in identifying and selecting agriculture industry awardees as part of the Annual Reef Environmental Stewardship Award.	
Status: Unfunded	**Duration:** 3 years
Lead Organization: To be determined	**Partner Organizations:** DLNR, DOH, EPA, NRCS, NOA
Estimated Cost: $30,000	**Potential Funding Sources:** DLNR, DOH, EPA, NRCS, NOAA
Staff, Training & Technical Expertise Needs: Technical expertise and writing skills to document lessons learned from actions to reduce land-based pollution threats for public consumption.	**Significance of Expected Outputs:** Local action strategies are being developed to address a variety of threats to coral reefs in Hawai`i. This action will serve as an important conduit of information on land-based pollution threats and actions to reduce those threats to Hawai`i's Living Reef Program
Proposed Action: Integrating Hawaiian Culture and Traditional Practices in Addressing Land-Based Pollution Threats to Coral Reefs (Statewide and Pacific Region)	
Description: This action would focus on identifying and integrating Hawaiian culture and traditional practices in addressing land-based pollution threats in the priority ahupua`a (Honolulu, Maui; Kawela-Kapualei, Moloka`i; Hanalei, Kaua`i). A written and oral history would be developed for each area through meetings and workshops with members of the Native Hawaiian community. The role of traditional fishponds in controlling land-based pollution as well as the impacts of sedimentation on fishpond preservation will be examined. A comparison of traditional and modern practices to control sediment runoff and other land-based pollution threats would provide insights on how and where traditional practices can be integrated with, enhance, or replace current strategies.	
Status: Unfunded	**Duration:** 6 months
Lead Organization: To be determined	**Partner Organizations:** DLNR, DOH, EPA, NRCS, NOA
Estimated Cost: $20,000	**Potential Funding Sources:** DLNR, DOH, EPA, NRCS, NOAA
Staff, Training & Technical Expertise Needs: Knowledge of Hawaiian cultural practices.	**Significance of Expected Outputs:** The traditional system of ahupua`a management provides valuable lessons learned to address modern day pollution problems.

Section 6.0
References

6.0 References

Berg, N., B. McGurk, and R.S. Calhoun. 1997. *Hydrology and Land Use Effects on the Hanalei National Wildlife Refuge, Kaua`i, Hawai`i.* USDA Forest Service, Interagency Agreement 14-48-0001-94588, Final Report, 62 p.

Brown, E.K. 1999. S*ediment Dynamics, Water Motion Characteristics, and Human Use Patterns within Honolua Bay MLCD.* Submitted to State of Hawai`i Department of Land and Natural Resources in partial fulfillment of Conservation District Use Permit Number: MA-2772. 23 pp.

Brown, E.K. 2003. *Short-term trends in coral communities at Honolua Bay, West Maui,* Presentation made at the Hawai`i Stakeholders Workshop, June 9, 2003, Maui.

Calhoun, R.S. 1999. *The Sediment Budget of Hanalei Bay, Kaua`i, Hawai`i.* Ph.D. Dissertation in Geology and Geophysics, University of Hawai`i. UMI Number 9951173, 94 pp.

Calhoun, R.S. and C.H. Fletcher. 1999. *Measured and predicted sediment yield from a subtropical, heavy rainfall, steep-sided river basin: Hanalei, Kaua`i, Hawaiian Islands.* Geomorphology 30: 213-226.

Calhoun, R.S., and Field, Michael E. 2002. *Beach and reef-flat sediments along the south shore of Moloka'i, Hawai'i, in Carbonate Beaches 2000*, Proceedings of the First International Symposium on Carbonate Sand Beaches, held in Key Largo, Florida, on December 5-8, 2000, American Society of Civil Engineers, p. 163-171.

Calhoun, R.S., C.H. Fletcher, and J.N. Harney. 2002. *A budget of marine and terrigenous sediments, Hanalei Bay, Kaua`i, Hawaiian Islands.* Sedimentary Geology. 150: 61-87.

Cochran, S.A., Roberts, Lucile M., and Evans, K.R. 2002. *Moloka'i fieldtrip guidebook: selected aspects of the geology, geography, and coral reefs of Moloka'i*: U.S. Geological Survey Open File Report 02-158

Carr, R.S., and Nipper, M. 2003. Final report on toxicity testing of sediments from Moloka`i and Maui, Hawai`i: USGS Marine Ecotoxicology Research Station, Texas A&M University -Corpus Christi, Center for Coastal Studies. Report number TAMU-CC-0302-CCS.

Davidson, K., M. Hamnett and C. Minato (eds). 2003. *The First Four Years: Hawai`i Coral Reef Initiative Research Program, 1998-2002*. Social Science Research Institute, University of Hawai`i at Manoa. 72 pp.

D'Iorio, M. 2003. Mangroves and shoreline change on Moloka`i, Hawai`i: assessing the role of introduced Rhizophore mangle in sediment dynamics and coastal change using remote sensing and GIS., University of California - Santa Cruz, Ph.D.

Dollar, S.J. and R. W. Grigg. *Anthropogenic and Natural Stresses on Selected Coral Reefs in Hawai`i: A Multi-Decade Synthesis of Impact and Recovery*. Pacific Science. In press.

Environmental Consultants, Inc. 1974. H*onolua Bay Study: Marine Geological, Physical, and Biological Surveys*. Prepared for Belt Collins and Associates, 62 pp.

Empowerment Zone/Enterprise Community Program (EZ/EC). 2002. Funding Report; www.ezec.gov/Communit/Moloka`i.html

Empowerment Zone/Enterprise Community Program (EZ/EC). 2000. Benchmark Summary Report; www.ezec.gov/Communit/Moloka`i.html

Field, M. 2003. Presentation made at the Hawai`i Stakeholders Workshop, June 9, 2003, Maui.

Friedlander, A.M., E.K. Brown, P.L. Jokiel, W.R. Smith, and K.S. Rodgers. 2003. *Effects of habitat, wave exposure, and marine protected area status on coral reef fish assemblages in the Hawaiian archipelago.* Coral Reefs 22: 291-305.

Grigg, R.W. 1994. *Effects of Sewage Discharge, Fishing Pressure, and Habitat Complexity on Coral Ecosystems and Reef Fishes in Hawai`i*. Marine Ecology Progress Series, Vol. 103: 25-34.

Hanalei Heritage River Program. 2002. *Environmental Protection Agency Watershed Initiative Grant Proposal and Work Plan.*

Hawai`i State Department of Health, Environmental Planning Office (DOH). 2002. *Final 2002 List of Impaired Waters in Hawai`i Prepared Under Clean Water Act Section 303 (d).* Prepared by K. Henderson and J. Harrigan, Hawai`i State Department of Health, Environmental Planning Office 61 pp.

Hunter, C. 2000. *Ecological Successes of Alien and Invasive Algal Species in Hawai`i. Final Report 1999-2000*, Hawai`i Coral Reef Initiative, http://www.hawaii.edu/ssri/hcri/rp/reports_by_principal_investigator-hunter.htm#

Jokiel, P.L.; E.K. Brown; A. Friedlander; S. Ku`ulei Rodgers; and W.R. Smith. *Hawai`i Coral Reef Assessment and Monitoring Program: Spatial patterns and temporal dynamics in reef coral communities.* In press.

Kamehameha Schools Press. 1994. *Life in Early Hawai`i, The Ahupua`a*. Honolulu. Third edition.

Maui Land & Pineapple Company, 2003. Discussions with Wes Nohara.

Moloka`i-Lana`i Soil and Water Conservation District, 2002. *Watershed Restoration Action Strategy for the South Shore of Moloka`i (WRAS)*, Final report.

NOAA, 2002a. *A National Coral Reef Action Strategy: Report to Congress*, 118 pp.

NOAA, 2002b. *Hawai`i's Marine Protected Species, A Handbook for Ocean Users, The Laws and Regulations for Federally Protected Marine Resources,* 51 pp.

Orazio, C., R. Gale, J. Meadows, K. Feltz, P. Peterman, K. Echols, T. May, R. Wiedmeyer, M. Walther, W. Brumbaugh, C. Berg, and W. Steiner. 2002. *Survey of Organic Chemical Contaminants in Water, Sediment and Biota Sampled from the Hanalei River, Kaua`i in December 2001.* United States Geological Survey Report Number CERC-8335-FY03-31-01, 17 pp.

Storlazzi, C.D., McManus, MA, Logan JB and McLaughlin, BE. 2003a. *Coastal Circulation and Sediment Dynamics along West Maui, Hawai`i. Part II: 2003 Hydrographic Survey Cruises, A-3-03-HW and A-4-03-HW Report on the Spatial Structure of Currents, Temperature, Salinity, and Turbidity along Western Maui.* U.S. Geological Survey Open-File Report 03-430, 50 pp. http://geopubs.wr.usgs.gov/open-file/of03-430/.

Storlazzi, C.D., Logan, J.B., and Field, M.E, 2003b, Quantitative morphology of a fringing reef from high-resolution laser bathymetry: Southern Moloka`i, Hawai`i: Geological Society of America Bulletin, v. 115, no. 11, p. 1344-1355.

The Nature Conservancy. 2003. E*ast Moloka`i Watershed Partnership Strategic Plan for the South Slope*.

Torricer, L., G. Akita, G.A. Anzai, L. Boucher, R. Fantine, T. Kobayashi, G. Muraoka, H. Price, and S. Takenaka. 1979. *Marine Option Program Data Acquisition Project: Honolua Bay, Maui.* Sea Grant College Program, University of Hawai`i, 38 pp.

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APPENDIX A

PRIORITY ACTION PLAN AND FUNDING STATUS

Priority Action Plan and Funding Status
March 2004[1]

Priority Action	Estimated Cost	Preliminary Commitment	Funds Needed Year 1	Potential Funding Sources	Potential Fund Commitment and Partnering Opportunities
Honolua, Maui					
1A: Innovative Wastewater and Storm-Water Management Systems Workshop and Design Recommendations for Public Restroom Facility and Parking Lot in a Sensitive Coastal Environment (6 mo)	$40K	$20-40K (DLNR)	$20-40K ($20K non-federal matching funds required)	EPA, DOH, CZM private/NGO	• Suggest link with HI Chapter of American Inst. Of Architects and Society of Civil Engineers in conduct/hosting/participants for workshop (S. Miller, CZM) • Need for review of outputs from previous workshops conducted by C&C and State on construction and other types of stormwater BMPs to build on for this workshop (D. Kelly, SWCD) • High public use of Honolua makes this urgent need (W. Suzuki, MLP) • CZM will be issuing RFP for workshop on low impact development (S. Miller, CZM) • Eligible for CWA 319 funding from DOH (A. Shileikis, EPA)
1B: Soil Erosion and Surface Water Runoff Control for Land Use Transition from Pineapple Cultivation to Resort, Residential, and Recreational Development (3 years)	$300K	$50K (DOH)		EPA, DOH, NRCS, CZM private/NGO	• Eligible for CWA 319 funding from DOH (A. Shileikis, EPA)
2A: Synthesis and Critical Analysis of Available Information on Land Use, Runoff, Water Quality, and the Health of the Coral Reef Ecosystem at Honolua Bay (6 mo)	$25K		$25K	NOAA, DLNR, HCRI, private/NGO	• Potential navigator assistance from G. Smith, FWS (M. Molina, FWS) • An additional $50K to come later in FY04 could potentially help fund Honolua 2A and potential to reduce/waive match based on leveraging (M. Molina, FWS)
2B: Carrying Capacity Study to Manage Public Use of Honolua Bay (6 mo)	$30K	$30K (MLPC)	-	NOAA, DLNR, HCRI, private/NGO	• Potential funding via FWS-DJ program if properly proposed (M. Molina, FWS) • Preliminary commitment from Maui Land and Pineapple Company (MLPC) was made during Maui public meeting held February 13, 2004
Proposed Action: Spatial and Temporal Variability in Historic Near-Shore Sedimentation Recorded in Coral Skeletons	$12K	$6K (USGS)			• Partially funded

Priority Action Plan and Funding Status
March 2004[1] (Continued)

Priority Action	Estimated Cost	Preliminary Commitment	Funds Needed Year 1	Potential Funding Sources	Potential Fund Commitment and Partnering Opportunities
Proposed Action: Wave Energy and Sediment Suspension Gradients Along Northwest Maui	$52K	$52K (USGS)			• Fully funded
Kawela-Kapualei, Molokai					
1C: East Molokai Watershed Partnership – Phase II Fence Extension in Upper Watershed to Control Feral Animals (1 yr)	$245K	$75K (USFWS) $20K (NRCS) $75K (Maui DPW) $25K (Maui BWS) $50K (TNC)	$5K	FWS, EPA, NRCS, DOH, private/NGO	• NFWF call for grants to support coral reef conservation (J. Newman, FWS) • $75K is from Conservation Partnerships Program, C. Rowland (M. Molina, FWS) • An additional $50K to come later in FY04 could potentially help fund Honolua 2A and Hanalei 2C and potential to reduce/waive match based on leveraging (M. Molina, FWS) • Eligible for CWA 319 grant funding and SRF loan from DOH (A. Shileikis, EPA)
1D: East Molokai Watershed Partnership – Feral Animal Control Program Associated with Phase II Fence Extension (5 yr)	$670K	$100K (Maui BWS) $100K (KS) $100K (TNC) $200K (State NARS)	$170K (5th year)	EPA, NRCS, DOH, private/NGO	• USGS providing mammalogist (Steve Hess) for monitoring studies (B. Steiner, USGS) • Eligible for CWA 319 funding from DOH (A. Shileikis, EPA)
1E: East Molokai Watershed Partnership – Fire Task Force and Management Program (5 yr)	$100K		$25K	EPA, NRCS, DOH, private/NGO	• County of Maui ($30K?), OHA ($40K?), FireWise-DLNR ($?), RC&D ($?) (D. Kelly, SWCD) • Eligible for CWA 319 funding from DOH (A. Shileikis, EPA)
1F: East Molokai Watershed Partnership – Sediment Basin Construction and Maintenance (4 yr)	$2 million		$500K	EPA, NRCS, DOH, private/NGO	• Eligible for SRF loan from DOH (A. Shileikis, EPA) • Possibility for funding as wetlands restoration (FWS)
1G: Finalized Implementation of Watershed Restoration Strategy for the South Shore of Molokai (3 yr)	$100K	$100K (DOH)		EPA, NRCS, DOH, CZM	• USGS is providing restoration and monitoring experience (Jim Jacobi) in upper watershed (B. Steiner, USGS) • County of Maui ($?), Rural Development-UH for monitoring ($?) • Eligible for CWA 319 funding from DOH (A. Shileikis, EPA)

Priority Action Plan and Funding Status
March 2004[1] (Continued)

Priority Action	Estimated Cost	Preliminary Commitment	Funds Needed Year 1	Potential Funding Sources	Potential Fund Commitment and Partnering Opportunities
Hanalei, Kauai					
2C: Analysis of 10-Year Data Set on Coral Cover in Hanalei Bay (6 mo)	$25K	$25K (USGS)	-	NOAA, EPA, HCRI	• NFWF call for grants to support coral reef conservation (J. Newman, FWS) • USGS-PIERC will look at this; contact David Helweg 808-956-5669 (B. Steiner, USGS) • Potential navigator assistance from G. Smith (M. Molina, FWS)
Cross-Cutting Actions					
2D: Regional Workshop to Develop Indicators and Protocols to Assess Coral Reef Health and Threats from Land-Based Pollution (3 mo)	$50K	$20K (EPA) $25K (NOAA) $5K (USGS)		NOAA, EPA, USGS, private/NGO	• Hanalei long term dataset may serve as model indicator study, host in Hanalei (C. Berg, Hanalei Hui)
2E: Long-Term Monitoring of Three Priority Ahupua`a Using Pollution-Impact-Sensitive Indicators (3 yrs)	$600K	$25K (USGS)	$200K	NOAA, USGS, HCRI, DLNR	• Ongoing data collection of water quality data ($25K) and analysis of historical sedimentation rates from coral skeletons for Honolua Bay (USGS, C. Storlazzi) • Need to coordinate TMDL studies, e.g. Hanalei TMDL (J. Harrigan, DOH) • Potential new action, USGS Molokai Stream Flow Study (E. Misaki)
2F: Assessment of coral and fish disease		Funded by HCRI		HCRI	• Funded by HCRI; however, not necessarily focused on LAS priority ahupua`a • Talk to P.I (Parrish, Lewis) to encourage study to cover LAS priority ahupua`a
3A: Coordinator for Implementation and Monitoring (3 yrs)	$225K	$75K (DLNR, NRCS)	-	NOAA	• Suggest link with academic institution with watershed management curriculum to provide on-the-job training for students in watershed management; this might allow CRLBP to tap into different grant sources (education) to fund position as well as additional help (S. Miller, CZM) • NOAA has $40K for LBP coordinator (J. Kelsey) • Potential to coordinate with Sea Grant, currently hiring watershed coordinators • DOH is looking for an intern to help support LAS implementation for Spring 2004 • Eligible for CWA 319 funding from DOH (A. Shileikis, EPA)

Priority Action Plan and Funding Status
March 2004[1] (Continued)

Priority Action	Estimated Cost	Preliminary Commitment	Funds Needed Year 1	Potential Funding Sources	Potential Fund Commitment and Partnering Opportunities
Cross-Cutting Actions					
3B: Workshop Series on Land-Based Pollution Threats to Coral Reefs, progress repts from ahupua'a (3 yrs)	$50K	$3K (DLNR, 1st Workshop) $3K USGS	-	NOAA, EPA, DLNR, DOH, CZM, private/NGO	• USGS will fund $3,000 in year 1; contact Dirk Van Dyk at 808-956-5668/69) (B. Steiner, USGS) • Hanalei offers to host 1st Workshop (C. Berg, Hanalei Hui) • CZM is responsible for $80K from 319 funds set aside for implementing BMPs for pollution control and following up with long-term monitoring (S. Miller) • Eligible for CWA 319 funding from DOH (A. Shileikis, EPA)
Other Priority Actions					
Potential study of sea turtle health and use in the three ahupua`a to correlate with water quality and other parameters			$10-20K in FY04 for both projects can	USFWS Coastal Program	• Build on USGS research (T.Work) in Kaneohe Bay and Kona and link with LAS action on coral and fish disease (2F), potential commitment of $10-20K in FY04 for both projects and can re-examine funding needs in FY05 (C. Swenson, FWS)
Control of alien algae in Honolua Bay	$15K			DLNR, EPA, NOAA, HCRI	• Inclusion of this as priority action made during Maui public meeting held on February 13, 2004.
Wetland restoration to improve marine water quality and restore endangered species habitats in Molokai and Hanalei				USFWS-National Grant Program	• National Coastal Wetlands Grants (From USFWS to State of Hawaii) can provide up to $1 million.RFP goes out from the State around June 2004. Scoring of proposal greatly increased by tying action to endangered species restoration (e.g. benefits to stilts, moorhen, sea turtles, listed plants, etc. Can work with proposal writer to make suggestions and strengthen proposal (C. Swenson, FWS)
Potential new priority action to fund salaries for base staff (TNC) for Molokai					• TNC biggest challenge is to retain/increase long term funding for base staff, needs salaries and to identify federal (or private) fund sources to match state grants to achieve this (E. Misaki, TNC)
Potential new priority action for fire suppression -Molokai					• County of Maui, DLNR, DOF providing funds/utility truck, this is in addition to 1E (D. Kelly, SWCD)

Note:

[1] Priority actions and preliminary funding commitments based on *Hawaii's Local Action Strategy to Address Land-Based Pollution Threats to Coral Reefs* and consultations held at an interagency funding meeting held January 7, 2004, in Honolulu and a public meeting held February 13, 2004, on Maui.

APPENDIX B

INVENTORY OF KEY FEDERAL FUNDING OPPORUNITIES FOR POSSIBLE USE TO SUPPORT/MPLEMENT LOCAL ACTION STRATEGIES

Inventory of Key Federal Funding Opportunities for Possible Use to Support/Implement Local Action Strategies

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
NOAA				
	NOAA Coral Reef Conservation Program	Aug. / Sep. for the next FY		
	Coral Reef Conservation Fund - NFWF	Jan. 31, 2004	http://www.nfwf.org/programs/grant_apply.htm	
	State and Territory Coral Reef Ecosystem Management Grants	Mar. 12, 2004	www.coralreef.noaa.gov/grants.html	
	State and Territory Coral Reef Ecosystem Monitoring Grants	Mar. 12, 2004	www.coralreef.noaa.gov/grants.html	
	Coral Reef Ecosystem Research Grants		www.nurp.noaa.gov/noaacoral.html	
	Projects to Improve or Amend Coral Reef Fishery Management Plans	Mar. 12, 2004	www.coralreef.noaa.gov/grants.html	
	General Coral Reef Conservation Grants	Mar. 12, 2004	www.coralreef.noaa.gov/grants.html	
	International Coral Reef Conservation Grants	Mar. 12, 2004	www.coralreef.noaa.gov/grants.html	
	NOAA Coastal Ocean Program	various deadlines	www.cop.noaa.gov/funding.html	
	NOAA Community Based Restoration Program Individual Project Grants	Closed Sept. 12, 2003	www.nmfs.noaa.gov/habitat/restoration/funding_opportunities/funding.html	check website for updates
	NOAA Community-based Habitat Restoration National and Regional Partnership Grants	Dec. 5, 2003	www.nmfs.noaa.gov/habitat/restoration/funding_opportunities/funding.html	check website for updates
DOI				
FWS	Pacific Islands Coastal Program		http://pacificislands.fws.gov/worg/orghc_conpart.html	
	Partners for Fish & Wildlife Program		http://www.fws.gov	
	Private Stewardship Grants Program		http://www.fws.gov	
	Hawaii Biodiversity Joint Venture		http://www.fws.gov	
	Sportfish Restoration Program		http://www.fws.gov	
	Wildlife Restoration Program		http://www.fws.gov	
	Clean Vessel Program		http://www.fws.gov	
	Coastal Wetlands Conservation		http://www.fws.gov	
	State Wildlife Grants Program		http://www.fws.gov	
	Endangered Species Section 6		http://endangered.fws.gov/grants/private_stewardship/index.html	
	Landowner Incentive Program		http://www.fws.gov	
OIA	Coral Reef Initiative Program		http://www.doi.gov/oia	
	Marine Resources Pacific Consortium		http://www.uog.edu/marepac	
	Technical Assistance Program			
	Capital Improvements program			

Inventory of Key Federal Funding Opportunities for Possible Use to Support/Implement Local Action Strategies (Continued)

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
DOI (Continued)				
NPS	Wild & Scenic Rivers program		http://www.nps.gov	
USGS	Cooperative Water Program		http://www.usgs.gov	
	State Water Resources Research			
USDA				
	Environmental Quality Incentives Program (EQIP)		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Conservation Reserve Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Wetlands Reserve Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Grassland Reserve Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Wildlife Habitat Incentives Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Conservation Security Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Forestry Incentives Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Resource Conservation and Development Program		http://www.nrcs.usda.gov/programs/	
	NRCS Watershed Programs		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	NRCS Coral Funding -NFWF		http://www.nfwf.org/programs/grant_apply.htm	***new grant - 3 million - details pending check website for updates Contact: Howard C. Hankin National Aquatic Ecologist USDA - NRCS email: howard.hankin@usda.gov
	Environmental Education	Spring, 2004	www.epa.gov/enviroed/grants	
EPA				
	Environmental Justice Small Grants	December, 2003	http://yosemite.epa.gov/r9/fsfc.nsf/fundingsources?ReadForm	
	Environmental Justice Collaborative Problem Solving Grants	September, 2004	www.epa.gov/compliance/environmentaljustice/grants/ej-cps-grants.html	

Inventory of Key Federal Funding Opportunities for Possible Use to Support/Implement Local Action Strategies (Continued)

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
EPA (Continued)				
	Integrated Pest Management and Sustainable Agriculture Projects	Spring, 2004	www.epa.gov/pesticides/grants/r9_agfqpa.html	
	Star Grants	various deadlines	http://es.epa.gov/ncer/grants/rfa/	
	Pesticide Environmental Stewardship Program (PESP)	Summer, 2004	www.epa.gov/oppbppd1/PESP/grants.htm	
	Resource Conservation Funds	Spring, 2004	www.epa.gov/region09/waste/solid/funding.html	
	Water Quality Cooperative Agreements	Spring, 2004	www.epa.gov/region09/funding/water_quality.html	
	Watershed Initiative		www.epa.gov/owow/watershed/initiative/	
	Wetlands Protection Grants (State/Tribal/Local)	March 19,2004	www.epa.gov/owow/wetlands/initiative/#financial	
	BEACH Act Grants		www.epa.gov/waterscience/beaches	
	Clean Water Act State Revolving Fund		http://yosemite.epa.gov/r9/fsfc.nsf/fundingsources?ReadForm	
	Nonpoint Source Water Pollution Control	Jan. 15, 2004	http://yosemite.epa.gov/r9/fsfc.nsf/fundingsources?ReadForm	
	Water Quality Assessment and Planning	Continuous	http://aspe.os.dhhs.gov/cfda/p66454.htm	
	OSWER Innovation Initiative	Dec. 2003	www.epa.gov/oswer/iwg.htm	
	Multi-agency watershed grants page		www.epa.gov/watershedfunding/	
	General EPA grants page		http://www.epa.gov/ogd/	
DOJ				
	Law Enforcement Training Grands			
DOD				
ACOE	Work for Others	State deadlines	US Army Corps of Engineers is not a granting agency and does not have specific Congressional authorities and appropriations for coral research or protection. Congressional authorities or appropriates are available to the States, local governments or other non-profit entities to solve specific water resource problems in cost-sharing partnership with the ACOE. Information can be found in: US Army Corps of Engineers, Civil Works Policy, Pocket Reference Source; www.usace.army.mil/inet/functions/cw; For Caribbean, contact Jacksonville District: George Strain (904) 232-3833; For Pacific Islands, contact Honolulu District: Paul Mizue (808) 438-8880.	Corps performs work for State as a contractor. State Funds. Work acceptance at the District Level

Inventory of Key Federal Funding Opportunities for Possible Use to Support/Implement Local Action Strategies (Continued)

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
DOD (Continued)				
ACOE	Planning Assistance to the States	State deadlines		Technical assistance to State on coral ecosystem or watershed planning. Annual funding approved at Division level. Supports 1 - 2 year projects.
	Ecosystem Protection and Restoration; Section 1135, WRDA 1996; PL 104-303			Authorizes and funds cost sharing projects to modify existing state-federal projects to mitigate for past damages not previously considered in the project implementation. Project approval at the Division Level. Funds 1-2 year projects.
	Ecosystem Protection and Restoration: Section 206, WRDA 1996; PL 104-303			Authorizes and funds restoration of anthropogenic damages to the aquatic environment. Project approval at the Division Level. Funds 1-2 year projects.
	Estaurine Habitat Resotration; Estuary Resotration Act of 2000; PL 106-457			Funds Corps Technical assistance to a NOAA and State estuary habitat restoration program. Annual funding approved at Division level. Supports 1 - 2 year projects
	Beneficial Uses of Dredged Material; Section 204, WRDA 1992		US Army Corps of Engineers is not a granting agency and does not have specific Congressional authorities and appropriations for coral research or protection. Congressional authorities or appropriates are available to the States, local governments or other non-profit entities to solve specific water resource problems in cost-sharing partnership with the ACOE. Information can be found in: US Army Corps of Engineers, Civil Works Policy, Pocket Reference Source; www.usace.army.mil/inet/functions/cw; For Caribbean, contact Jacksonville District: George Strain (904) 232-3833; For Pacific Islands, contact Honolulu District: Paul Mizue (808) 438-8880.	Authorizes and funds protection, restoration and creation of aquatic and ecological habitats using dredged material. Annual funding approved at Division level. Supports 1-2 year projects.

Inventory of Key Federal Funding Opportunities for Possible Use to Support/Implement Local Action Strategies (Continued)

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
DOD (Continued)				
ACOE	Beneficial Uses of Dredged Material; Section 204, WRDA 1992		US Army Corps of Engineers is not a granting agency and does not have specific Congressional authorities and appropriations for coral research or protection. Congressional authorities or appropriates are available to the States, local governments or other non-profit entities to solve specific water resource problems in cost-sharing partnership with the ACOE. Information can be found in: US Army Corps of Engineers, Civil Works Policy, Pocket Reference Source; www.usace.army.mil/inet/functions/cw; For Caribbean, contact Jacksonville District: George Strain (904) 232-3833; For Pacific Islands, contact Honolulu District: Paul Mizue (808) 438-8880.	Authorizes and funds protection, restoration and creation of aquatic and ecological habitats using dredged material. Annual funding approved at Division level. Supports 1-2 year projects.
	Watershed Studies, General Investigations			Multiyear general investigations authorized and appropriated by Congress. Study process from start to finish may take longer than 5 years.
	Ecosystem Protection and Restoration; Sectin 210, WRDA 1996: PL 104-303			Specifically authorized projects. Multiyear general investigations approved by Congress. Supports projects of more than 5 years.
	Streamflow Restoration; Sectoin 102, Clean Water Act 1972; PL 92-500: Section 103, WRDA 1986; PL 99.662			Authorizes streamflow regulation from authorized projects for environmental restoration; Multiyear general investigations approved by Congress. Supports projects of more than 5 years.
	Aquatic Plant Control Program		US Army Corps of Engineers is not a granting agency and does not have specific Congressional authorities and appropriations for coral research or protection. Congressional authorities or appropriates are available to the States, local governments or other non-profit entities to solve specific water resource problems in cost-sharing partnership with the ACOE. Information can be found in: US Army Corps of Engineers, Civil Works Policy, Pocket Reference Source; www.usace.army.mil/inet/functions/cw; For Caribbean, contact Jacksonville District: George Strain (904) 232-3833; For Pacific Islands, contact Honolulu District: Paul Mizue (808) 438-8880.	Corps technical assistance program provides 2 weeks consultation services to the Division initiated by request from the District and State.

Inventory of Key Federal Funding Opportunities for Possible Use to Support/Implement Local Action Strategies (Continued)

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
DOD (Continued)				
ACOE	General Permit Authorizations			States can use this Corps permit authority to support its regulatory and planning programs. State must develop and enforce a program or plan prior to applying for a permit.
NASA				
	Office of Earth Science Research Division Office of Earth Science Applications Division	Continues	http://research.hq.nasa.gov/research.cfm	
NSF				
Geosciences (GEO)	Ocean Sciences (OCE) - Biological Oceanography Marine Geology and Geophysics - Chemical Oceanography - Oceanographic Technology & Interdisciplinary Coordination (OTIC) Earth Sciences (EAR) - Geology and Paleontology	See program for deadlines	http://www.nsf.gov/od/lpa/news/publicat/nsf04009/geo/start.htm	
Biological Sciences (BIO)	Environmental Biology (DEB) - Systematic and Population Biology - Biodiversity Surveys and Inventories - Long-term Ecological Research Biological Infrastructure (DBI) Molecular and Cellular Biosciences (MCB) Integrative Biology and Neuroscience (IBN)	See program for deadlines	http://www.nsf.gov/od/lpa/news/publicat/nsf04009/bio/start.htm	
Social, Behavioral & Economic Sciences (SBE)	Science and Society International Science and Engineering	See program for deadlines	http://www.nsf.gov/sbe/start.htm	
Foundation-wide	Biocomplexity in the Environment (BE) - Coupled Biogeochemical Cycles - Dynamics of Coupled Natural and Human Systems - Genome-enabled Environmental Science and Engineering	See program for deadlines	http://www.eng.nsf.gov/be/index.htm	

Inventory of Key Federal Funding Opportunities for Possible Use to Support/Implement Local Action Strategies (Continued)

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
Hawaii				
Department of Health	Polluted Runoff Control Program (Program) administers grant money it receives from the EPA through Section 319(h) of the Federal Clean Water Act.	new request for proposals coming out in March 04	http://hawaii.gov/doh/eh/cwb/prc/index.html	
Hawaii Coral Reef Initiative Research Program			http://www.hawaii.edu/ssri/hcri/ah/request_for_proposals.htm	

**** Last Update: 12/03**
**** Prepared by the Steering Committee, U.S. Coral Reef Task Force ****
**** Information may change. Please be sure to check sources for most recent information ****
**** Contact: Secretariat, US Coral Reef Task Force (www.coralreef.gov)**